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SLIEMA: A STUDY IN URBAN GROWTH

Paul V. Mifsud

Sliema, since 1948 [1] the largest town in the Maltese Islands, has been in existence for only about a century and a half and has attained its role as a major Maltese settlement less than a century ago (Table Two).

Diagram A shows the geology of Sliema to consist of a limestone rock outcrop that descends down to sea level from heights of about 33 meters. The outcrop has been dissected by eastward-flowing valleys such as *Wied Mejxu*, and *Wied il-Kbir/Wied Għomor*. The valleys are now deeply entrenched in the country rock. The waters they drain have swept the land of practically all the loose material which now forms the partly inundated, partly reclaimed, tiny alluvial plains at the heads of the three creeks of Msida, Lazzaretto and Sliema and of the three bays of Balluta, St Julian's and St George's.

Lang's map of *Soils of Malta and Gozo* [2] came much too late to record the type of soil, if any, that covered part of the Sliema peninsula. The map, however, shows that the land surrounding Sliema has xerorendsina soils which, having been developed in dry, semi-arid climates, have stronly varying structures and textures, and occur mainly in higher land reaches. They are brownish in colour and relatively useful for crop cultivation if well-watered if underwatered, being of calcereous rock origin, they become alkaline and lose their fertility. [3] If the Sliema peninsula had good soil and the necessary amounts of fresh water some kind of farming must have taken place prior to town development.

Blouet's thesis [4] includes a large assortment of diagrams of the Maltese Islands depicting in various manners the successive and, at times, complex local land uses up till 1798. Blouet shows places with the adjective 'XAGHRA' meaning 'waste land'; places with the term 'MANDRE' meaning livestock enclosures; places where 'GIARDINI' [5] were recorded by famous historians such as Abela; the

1. The Malta Census in *Abstract of the Maltese Islands* 1947/48 p. 8, Malta, 1948.
2. D.M. Lang, *Soils of Malta and Gozo*, London, 1960.
3. Sir D. Stamp (ed), *A Glossary of Geographical Terms*, second edition, London, 1966, p. 491.
4. B.W. Blouet, 'The Changing Landscape of Malta during the rule of the Order of St. John of Jersusalem, 1530 — 1798' — a Ph.D. thesis, a photocopy of which is to be found in the' Melitensia' section of the Old University Library; pp. 75, 76, 84, 99-113, 142.
5. 'GIARDINI' were fields usually situated in small, sheltered valleys served by perennial springs and produced a wide variety of crops.

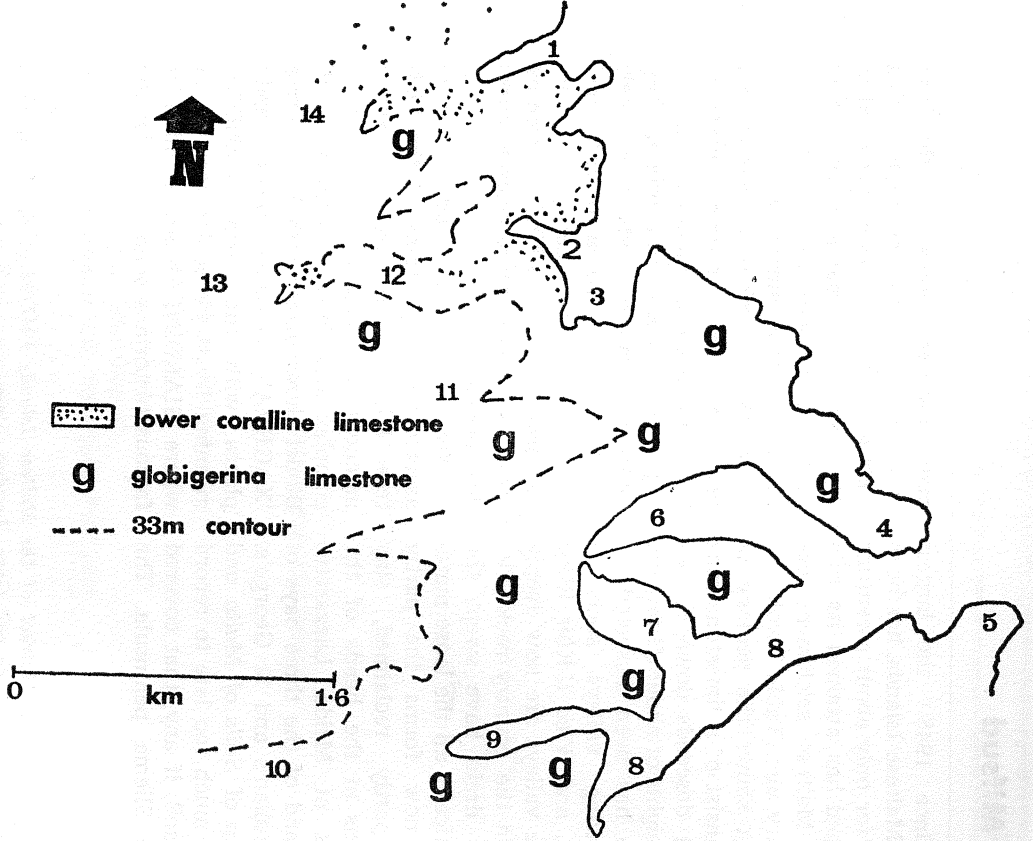

DIAGRAM **A**

GEOLOGICAL SKETCH PLAN OF SLIEMA

Key:. 1. St. George's Bay, 2. St. Julian's Bay, 3. Balluta Bay, 4. Dragut Point, 5. St. Elmo Point, 6. Sliema Creek, 7. Lazzaretto Creek, 8. Marsamxetto, 9. Msida Creek, 10. Msida Valley, 11. Wied il-Ballta. 12. Wied Għomor, 13. Wied il-Kbir, 14. Wied Bejxu.

'CASALS' [6] visited by Duzzina in 1575; distribution of settlements in the years 1436, 1603, 1617 and 1650; the roads pattern in c. 1650; and the distribution of windmills in c. 1800. In all of these references the Sliema area is a blank. There seems to have been no economic activities in Sliema till after the arrival of the British. Only in three diagrams does Blouet record a passing reference to the area.

In Fig 4.2 Blouet shows that in the early 17 century the estuary of *Wied il-Balluta* used to consist of an 'GHADIRA' — 'a temporary lake'. This would be the flat, U - shaped space at the head of Balluta Bay occupied today by the T junction of the Sliema coast-road and the steep main road that joins Balluta to the Savoy Hill. Fig 4.5. shows that between c. 1650 and c. 1680 the Grand Master gave two plots of land on the Sliema peninsula just north of Dragut Point on long lease. Fig 6.3 is a photocopy of a sketch plan that was drawn as part of a proposal for the construction of a fortress on Dragut Point. The proposal, which seems to have included a scheme for a settlement within the fortifications, was submitted to de Vilhena.

The 'Ghadira' referred to in Fig 4.2 by Blouet would have scared away would-be settlers because of the dangers of *mal aria* i.e. water-borne, - disease - infected air that would be brought about by stagnant water after rains. The two applicants who were granted land in the third quarter of the 17th century (Blouet's Fig 4.5 mentioned above) are, as yet, unknown. They may not have succeeded in developing their plots of land since their venture does not appear to have attracted other settlers. The town-fortress plan quoted in Blouet's Fig 6.3 was partly shelved due to lack of funds — only Fort Tigne was built.

Other sources, apart from Blouet, show that the Sliema area remained a complete wasteland till well into the 18th century. A map of Malta by a French cartographer, Echelle, c1700 found at the National Malta Library introduces details such as the Aqueduct (1610 — 1614) and the country churches dedicated to St Julian and St George overlooking the bays of St Julian and St George respectively. On this particular map the Sliema peninsula appears as an empty, hilly region.

An interesting problem is why Sliema developed after Valetta considering that physically speaking, the two peninsulas have many characteristics in common.

1. Both the 'Sciberras' and the 'Sliema' peninsulas are severly deficient in the supply of fresh water — one can note the absence of windmills in Sliema in the map referred to above and the many efforts by the Order to supply water to the City of Valletta.
2. Both peninsulas were rugged and dissected by deep, narrow valleys that, especially in Valetta, cut

6. 'CASAL' is the old Maltese term for village, 'HAL' having been reserved for large settlements.

TABLE ONE: ACREAGE OF THE HARBOURS

Harbour	Area (Km^2)	Area (Hectares)	Length of Shoreline (Km)
Grand Harbour	2.199	217.554	15.553
Marsamxetto	1.391	153.094	10.459

SOURCE: *The Statistical Abstract of the Maltese Islands.* Malta 1952.

TABLE TWO: CENSUS POPULATION OF THE SLIEMA AREA

Census Year	Sliema	Gżira	St. Julian's	Msida
1842	(with B'Kara)	—	(with B'Kara)	—
1851	582 (includes St. Julian's)	—	(with Sliema)	—
1861	800 (includes St. Julian's) +	—	(with Sliema) 607	—
1871	1600	—	607	—
1881	3,685	—	924	1,658
1891	8,237	—	1,597	2,149
1901	12,015	—	2,388	2,893
1911	14,129	—	4,304	3,627
1921	15,215	—	3,514	3,373
1931	19,730 (includes Gżira)	(included with Sliema)	4,894	3,627
1948	24,294 (Sliema overtook Valletta which city in 1948 had a pop. of 18,666)	6,925 (new census district constituted from part of Sliema)	9,122	6,064
1957	23,399	8,545	8,285	6,587
1967	21,000	9,575	7,394	11,437
1972	21,572	10,040	8,108	12,132
1977	20,123	9,884	8,043	12,051

+ Richardson, M. (1900) 'Aspects of the Demography of Modern Malta', Durham Univ., U.K., p.250, claims that "the population of Sliema in 1861 was only 300".

SOURCES:

Censuses of The Maltese Islands, 1842 - 1967, Malta.
Malta Blue Book.
Demographic Review of the Maltese Islands, 1972, Malta 1977.
Abstract of Maltese Statistics — Malta.

transversally across the peninsula and have produced very steep roads: stepped streets are common in Valetta.

3. Both Marsamxetto and the Grand Harbour are sheltered from the prevailing MAYYISTRAL (MISTRAL, N W wind) and both are exposed to the more violent GRIGAL (GREGALE N E wind) [7]. It is only inland from *Ras Hanżir* that the Grand Harbour is fully protected from the effects, direct and indirect, of the 'GRIGAL'. In Marsamxetto Harbour, only the creeks known as Sliema and Lazaretto (L-AZZARETTO) are sheltered (Diag. A)

Though the physical properties of the two peninsulas may be of equal value, from the economic point of view, the Valetta site is superior. The following points prove this statement.

(1) The major part of the approximately 218 hectares of water in the Grand Harbour (Table One) is deeper.

(2) Although with the exception of the uppermost part of the Creeks all of the approximately 153 hectares of water in Marsamxetto Harbour is more than 7.32 meters deep yet this harbour has only about three fourths the size of the area and shoreline length of the Grand Harbour.

(3) Settlements were discouraged from the Sliema peninsula by the absence of adequate protection from corsairs and by the presence of the Lazzaretto quarantines on Manoel Island.

(4) *Ceteris paribus*, in the late 1560s it was easier for the Order to build a town on Sciberras next to the fortified southern sides of the Grand Harbour where, incidentally, a dockyard already existed and only needed expansion and fortify Dragut Point by a fort rather than build a town on the Sliema peninsula and have to fortfy both its flanks.

During the 19th and 20th centuries three factors revolutionised the Sliema landscape. First, the British, in complete control of the Mediterranean and engaged in empire building in Asia and Africa, brought previously unknown prosperity to these Islands especially to the middle-class merchants. Even under the Order many merchants used to live in Valetta and would seek summer residence outside the City. With the increased trading possibilities under the British, prosperity multiplied and the demand for vacational lodgings in quiet, secluded spots increased rapidly. Under the Knights the route from Valetta to Rabat was the most popular site for summer residence.

7. Marsamxetto cannot be protected by a breakwater but the British found it possible to construct one upon submarine banks off the points of St Elmo and Ricasoli though the effects of swell have, on occasion, proved dangerous in both harbours to ships moored as far as 1.5 Km from their mouths. Harrison and Hubbard, *Valletta and the Three Cities* Malta, 1945 p. 84.

Note, for example, *Dar Il-Leuni*[8] built at Hamrun during the grandmastership of de Vilhena, San Antonio Gardens at Attard built by de Paule, and the small hunting lodge and stables at Boschetto Gardens built by La Valette and later fortified by Verdalle, the gardens themselves being greatly enlarged by Lascaris.

In 1856 two important events in the history of local transportation brought about a change in the direction of movement of annual migration from the Valetta area to summer residences. The first omnibus service in Malta was set up between Valetta and Lija. Its route earmarked a ribbon-like extension of lower-income group resiential buildings and of industrial enterprises that gradually engulfed the summer villas of the past century. Well-to-do summer vacationers were gradually forced to go elsewhere rather than stay in the overcrowded traditional summer resort areas.

Also in the same year the Government set up regulations regarding *Id-Dgħajsa tal-Passiġġieri* — a paddle-rowed Maltese boat service that was set up in the two harbours to carry passengers between Valetta and Sliema and between Valetta and the Three Cities.

So far Sliema seems to have grown very little (Table Two). It was as yet very poorly served by roads. Only the Order's forts, a small church and a few holiday houses seem to have been built until 1856. Surrounded by the sea on three sides and beautified by the forts Sliema offered a favourable alternative to the increasingly congested Hamrun region for purposes of vacation. *Id-Dgħajsa tal-Passiġġieri* provided a pleasant journey across the Harbours during the summer when the sea is usually easily navigable. Hence-forth the population of Sliema started growing because with the summer vacationers came the permanent settlers. Table Two shows that in a decade (1861 — 1871) the Sliema population grew from 300 to 1,600.

Id-Dgħajsa tal-Passiġġieri was succeeded in 1882 by *Il-Laneċ tal-Pass*. These *laneċ*, being larger and faster, shortened the trip between Valetta and Sliema and between Valetta and the Three Cities. Between 1881 and 1891 the Sliema population nearly trebled from 3,685 to 8,237 (Table Two).

Other developments in public transport in Malta indirectly helped Sliema to grow. The Railway Service, set up in 1883 between Valetta and Mtarfa via Hamrun, Santa Venera, B'Kara, Attard and Rabat resulted in further residential and industrial congestion in the Hamrun region and pushed the affluent people to the quieter Sliema region.

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8. The planning consultants Harrison and Hubbard, said about *Dar il-Leuni* that Prior to the 18th century the land now occupied by Hamrun was open country traversed by the Wignacourt Aqueduct, and a road linking Valetta with the interior of the Island. During the course of the century several country villas, set in spacious gardens of baroque design, were built alongside this road, by members of the Order. The most charming of these is Dar Il-Leuni.....". *op. cit.*, p.93.

The second factor was population over-spill from the Five Cities from 1850 to 1950. By 1861, 56,355 persons were living within the five walled cities of Bormla, Birgu, L-Isla, Floriana and Valetta — an area of about 3.238 square kilometres. This produced a population density within the Five Cities of 12,910[6] persons per square kilometre [9]. Overflow into areas that lay on the periphery of the Five Cities was inevitable. Hamrun, Paola and Sliema were immediately effected. Table Two shows the rapid rise in the population of Sliema between 1851 when, together with St Julian's Sliema had a population of only 582 and 1901 when by itself the town housed 12,015 people. A layout plan for Sliema dated 26 October 1865 [10] shows that the village of Sliema then consisted of a sparse communication network of ten roads of which four were named Sda. Fontana, Sda. Marina Tigne, Via Torre and Sda. Reale. Buildings stood scattered along these roads, none of which roads was more than half built up. Palazzo Sliema in Via Torre dominated the whole area and stood overlooking the sea in the whereabouts of the present Preluna Hotel. Another sketch plan, dated 13 March, 1906 [11] shows that the ten roads of the 1865 plan had by then been built on all sides; many more streets had been laid out and some of them built up. Sliema had now grown into a Y-shape along the coast with Fort Tigne forming the foot of the 'Y'.

The third and the last factor that has revolutionised the Sliema landscape came into effect during the last two decades and is not yet complete. Sliema has today become an important commercial centre expressed spatially by the multi-storey shop and office blocks. The Hotel Preluna is now the symbol of the new Sliema and has replaced the town's churches as the dominant of the skyline. To make room for the expanding retail and office land-uses the Sliema inhabitants are leaving town. Table Two shows that, having reached its population peak by 1948, Sliema has since then been losing its population. By 31 December 1977 the town's population had fallen to 20,123. The decline is expected to continue. The question is, who are the Sliema citizens that are leaving their hometown and, where are they going to?

Suburbanization of a town's population usually takes place in a piecemeal fashion. Urban dwellers only move as little as possible away from their hometown primarily in order to keep in close contact with relatives who have stayed behind and to make use of the town's specialized services. As the outward migration movement gathers momentum the demand for empty land for residential develop-

9. Adapted from the *Census of the Islands of Malta, Gozo and Comino,* Malta, 1863.
10. Skech Plans filed at the Lands Office, Department of Public Works, Beltissebh, to which Department the author is very grateful especially to the Director, Architect M. Busuttil B.Sc., BE & A., A & C.E.; and to Mr. Conti, the Chief Draughtsman.
11. Sketch Plans filed at Beltissebh, *op. cit.*

TABLE THREE: A COMPARISON BETWEEN HOUSEHOLDS & DWELLING AMENITIES IN MALTA, VALLETTA & SLIEMA

Locality/ Census Year	PRIVATE HOUSEHOLDS				PRIVATE DWELLINGS			
	Total No. of Households per locality	% of Total No. of Households per Locality living in Kerrejjas	Percentage of The Total No. of Household per Locality Having:—		Total No. of Private Dwellings per Locality	Percentage of The Total No. of Dwellings per Locality Having:—		
			water-closet	bath		piped-water	electricity supply	drainage service: sewer or cesspit
1957								
Malta	69970	2.81	92.01	23.28	64471	75.31	75.27	91.24
Valletta	4811	17.23	99.30	30.16	4456	87.81	82.07	100.00
Sliema	6388	0.41+	99.48	61.10	5983+	62.63+	59.50+	99.80
1967								
Malta	71380	1.77	93.74	45.99	80072	94.67	94.86	96.41
Valletta	4171	14.55	87.46	42.36	4259	98.52	98.15	99.58
Sliema	5993	0.10	99.34	76.21	6581	98.78	98.88	99.85

+ includes St. Julian's

SOURCES:

All data in this table has been compiled from the 1957 and 1967 Censuses of the Maltese Islands, namely:— *Census* 1957 — *The Maltese Islands: Report on the Population & Housing,* Malta 1959. Table H IV pp. 185 — 191; Table H V pp. 199, 200; and Table HXIc pp. 260, 261.
Malta Census 1967 — *Report on Housing Characteristics* Malta. Table H13a pp. 396,397; Table H13b p.404; Table H15 pp. 413-415; Table H24a p. 454; Table H24b p. 455; Table H26 p. 457.

ment on the periphery of the town keeps increasing. Land values of peripheral land rise accordingly and only the higher and upper-middle income groups can afford to purchase empty peripheral land and build houses, or to rent speculatively — built suburban houses [12]. Sliema, therefore, is probably losing its wealthier inhabitants. By the same arguments these upper-and upper-middle income groups citizens should be settling in areas peripheral to Sliema. Hence, the host suburbs for Sliema's higher income emigrants are most probably places like Is-Swieqi, St Andrews, The Village, Upper and Lower Kappara. One may not tell how many of these suburbial residents of Sliema originate from that town before the 1980 Census of the population of the Maltese Islands has been collected and analysed. Two points may, however, be made.

First, that, judging from the advertised high prices for houses and land in the Sliema suburbs and from the general outward appearance and upkeep of these areas one cannot but assume that the families who live there come mainly from the upper — and mid-upper income groups. Secondly, it may be noted that Swieqi alone has about 216 registered voters in the latest edition of the electoral register for the Maltese Islands [13]. Taking these voters to be mainly married couples with one child per couple being below the voting age the Swieqi population should number about 400. The populations in these new Sliema suburbs are therefore quite substantial albeit their being lost amongst the official population figures of the parishes to which these suburbs still belong.

A town that is losing its richer citizens should be expected to be getting poor. Table Three shows that Sliema has not, in the past, attracted any significant number of low-income dwellers. For example, in 1967 while out of the population of Malta 1.77% were common-tenement dwellers [14], and while 14.55% of the Valletta citizens lived in common-tenement houses, in Sliema only 0.1% of the poulation lived in *Kerrejjas* in 1967. Similarly, Sliema is shown to lead in the rate of availability of domestic amenities per household; namely water closets and baths. It is a pity that the outward migration of the town's higher-income residential groups may lessen the town's advantageous position in this field.

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12. See, for example, W. Bell *The City, the Suburb, and a Theory of Social Choice* in Greer, Setal (eds), *The New Urbanization*, New York, 1968, p. 132-68.
13. *Electoral Register for the Maltese Islands, April* 1978, 7th Electoral District — Malta 1978.
14. In the introductory annotations of the *Population Census of the Maltese Islands* 1881, the term KERREJJA (common-tenement house) is thus defined "The Kerrejja usually is an old large house having each room, large or small, let to a distinct family", p.5.

A STUDY OF BRAINS: An Exercise in the Understanding of Evolutionary Trends at Work

Frank Pace

It is perhaps important to point out that not all animals have a "brain". In fact, being unicellular or colonial conglomerations of cells, Protozoa have not yet acquired the complexities of differentiation found in higher animals. Althouh these simple animals do show sensitivity and respond to environmental stimuli they still lack nerve cells. In the Coelenterates (jellyfish, hydras and sea-anemones) one gets differentiation of the body into different cell types... some of these being directly concerned with the transmisson of nerve impulses. The multipolar neurons and their axons ramify through the bodies of the these diploblastic animals and the systems are so diffuse that the set-up is usually referred to as a "nerve-net". However this tends to become aggregated to form specialized nerve tracts in animals which are higher up in the evolutionary tree. Since many sense organs become concentrated in the head (cephalization) concommitantly the nerve tracts in these regions become further elaborated and nerve masses or ganglia are formed. These in fact become the rudiments from which higher and more complex brains arise.

In Turbellarians a mass of nervous tissue becomes associated with the eves, the chemoreceptors and the rheoceptors (current detectors). Removal of such a brain will produce a disorganization of complex forms of locomotion, the animal becomes hypersensitive and the "inhibiting" effect of the brain is lost. A simpler kind of response is obtained when the supra-oesophageal or cerebral ganglia of annelids and arthropods are removed. The cerebral ganglia act primarily as a sensory relay centre which passes information to the motor sub-oesphageal ganglia via the commisures. If one of the latter is cut, the limbs on the cut side show additional activity and "circus" movements ensues due to the inability of the cerebral ganglia in inhibiting these responses. One gets a tendency in the animal kingdom towards an increase in the centralization of the control of activities. Thus the primitive local reflexes tend to get a certain degree of dependence on the integrating areas and higher motor centre. These excite lower motor centres and finally one gets the response from the effectors. Concommitantly with this trend one gets more elaborate connections and interrelations in the higher animal's brain.

SENSORY CENTRES —— HIGHER MOTOR AND INTEGRATING CENTRES —— LOWER MOTOR CENTRES

Environment Stimuli Effectors

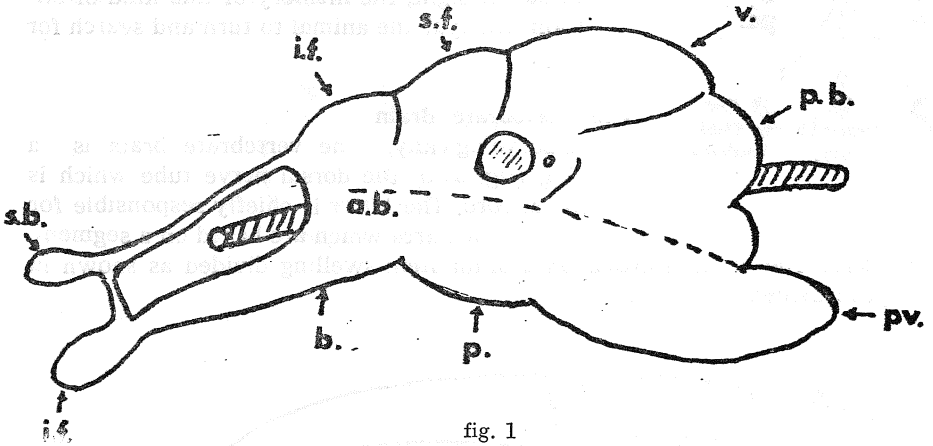


fig. 1
The Cuttlefish Brain

Guide to labelling: a.b. anterior basal lobe, i.f. inferior frontal lobe, s.f. superior frontal lobe, v. vertical lobe, p.b. posterior basal lobe, b. branchial lobe, p. pedal lobe, pv. palliovisceral Lobe, s.b. superior buccal lobe.

A Complex Invertebrate Brain as exemplified by that of the Cephalopod Mollusc. (fig. 1)

Using classical neurological techniques one can work out the function of the different parts. Removal of the supraoesophagal part or mass results in the usual restlessness and hypersensitivity as with the annelids. The squid swims about continuously and if just one side has been removed circus movement is shown. If more local incisions are made, one finds that the anterior lobe of the basal part acts as a higher motor centre for co-ordinating swimming. It inhibits the action of the palliovisceral lobe which is responsible for the continual mantle contractions and funnel and fin movements. The anterior basal lobe itself seems to be controlled by higher sensory centres around the optic nerve. This centre is a very important sensory centre in Cephalopods. Stimulation of all lobes one by one resulted in co-ordinated activity of different sets of muscles as shown in the ordinary behaviour of the animal. One would therefore conclude that the different lobes are arranged on a hierarchial principle, and thus one gets multiple control of lower motor centres from the higher motor centres.

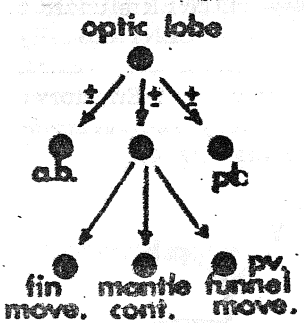


fig. 2

Stimulation of the vertical and frontal lobes of the cephaloped brain does not affect muscles and swimming. These regions seem to be important for learning and integrated complex behavioural patterns found in the animals e.g. as soon as a prey moves out of sight, the memory of this kind of stimulation will spur the animal to turn and search for the prey.

The Vertebrate Brain

Embryologically, the vertebrate brain is a swelling (fig. 3) of the dorsal nerve tube which is the spinal cord. The latter is chiefly responsible for involutary reflex arcs which are based on a segmental pattern. The brain is based on a brain stem swelling divided as shown in the figure below.

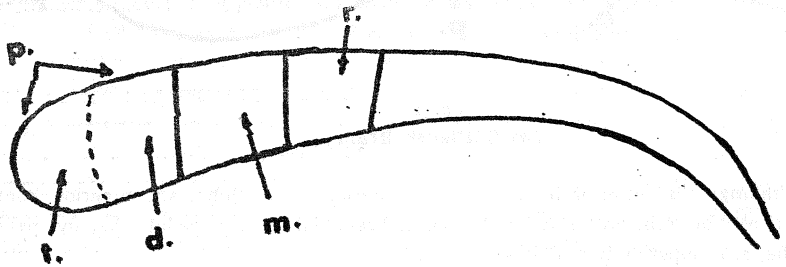


fig. 3

Guide to labelling: p. prosencephalon, t: telencephalon, d. diencephalon, m. mesencephalon, r. rhombencephalon.

Early on in evolution, occurs the division of the prosenccephalon into a telencephalon and a diencephalon. All these parts have been elaborated further in evolution so that the diencephalon, to quote this part as an example, gave rise to the thalamus, epithalamus, hypothalamus and the infundibulum. Primitivily, in fact, the brain shows an acute resemblance to the spinal cord both in its structure and segmental pattern. Thus somatic dorsal nerves carry sensory impulses from skin and muscle proprioreceptors. Visceral nerves carry sensory impulses from the smooth muscles of the viscera e.g. gut, uterus and blood vessels. Correspondingly one gets the somatic motor nerves supplying the voluntary muscle and the visceral motor nerves supplying the smooth and involuntary masculature. This set up is found in all vertebrates. In addition one may get in the higher forms, the visceral part of this pattern contributing towards the specialized autonomic nervous system with antagonistic sympathetic

and parasympathetic contributions by which involuntary muscles are under a more highly elaborated control. Concommitantly with this one gets ventrally situated gangalia which establish new connections with dorsal and ventral nerve roots. The medulla oblongata, being the hinder part of the brain, shows this differentiation of entry of somatic sensory, visceral sensory, visceral motor and somatic motor nerves quite clearly by a sulcus limitans. (fig. 4)

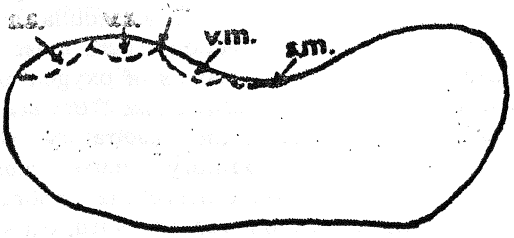
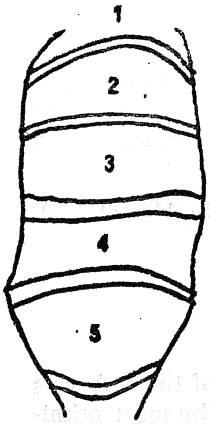


fig. 4

Gudie to labelling: s.s somatic sensory, v.s. visceral sensory, s.l. sulcus limitans, v.m. visceral motor ,s.m. somatic motor.

All but two of the cranial nerves end either in a sensory or a motor centre. These two are the Optic nerve (II) and the Olfactory (I). Cranial nerve I is very old evolutionary speaking; in fact there are reasons to believe that it preceded the brain. The optic nerve is not a derivation from the brain but a sensory tract arising from the eye. Embryologically the brain is formed from neuricrest cells which link the fold ends of an ectodermal longitudinally directed invagination. Between five bridges of nervous (fig. 5) material one gets spaces of non-nervous tissue. These represent a sequence of five segments. These segments later contributed to the main parts of the brain and their dorsal and ventral roots gave existence to the cranial nerves.



	Corresponding Cranial nerves	
	Dorsal	Ventral
Seg I Cerebellum	VI	III
Seg II Optic Tectum	VII, VIII	IV
Seg III Habenular	VII	VI
Seg IV Anterior commisure	IX	XII
Seg V Corpus callosum		

The Rhombencephalon (Hind-Brain)

This comprises the myelencephalon (medulla oblongata) and the metencephalon which includes the cerebellum and the pons. Histologically it shows up as descrete nuclei of axons; nervous tissue randomly distributed surrounds these nuclei. At certain regions of the medulla

oblongata one gets a set of interlacing fibres which form motor and sensory decussations. If one removes the medulla oblongata and all the other parts of the brain, the spinal animal shows, after a period of spinal shock, a certain amount of mascular tone. However the animal cannot respire and this is accompanied by a fall in blood pressure. A bulbal animal however (i.e. with an intact medulla oblongata) can exhibit local reflexes and other reactions such as vomiting, sneezing and swallowing. The animal can respire and can control its blood pressure to some extent. Thus in the medulla oblongata there are nuclei centres responsible for motor function. There must also be some kind of respiratory centre sensitive to the tensions of oxygen and carbon diovide in the blood. The work of Pitts et al. showed that there are two sets ofnuclei; the expiratory nuclei being dorsal to the inspiratory nuclei. Application of electrode shocks into the inspiratory centre caused an increase of discharges of potentials in the phrenic nerve, the diaphragm contracted for three minutes and rhythmic respiration was abolished. On stimulating the expiratory centre, one would get a decrease in phrenic nerve discharge, the animal would breath out for one minute and after this the animal would breath in again. In primitive vertebrates, the medulla receives impulses from the lateral line system. (fig. 6) In the evolution of the tetrapods this has been drastically reduced and the nervous connections became adapted to serve the labyrinth of the ear, the sole vestige and functional part of the lateral line system. With the medulla one gets the associated vascularised non-nervous posterior choroid plexus.

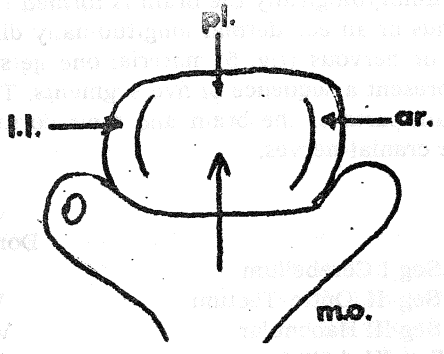


fig. 6

Guide to labelling: ar. archicerebellum, pl paleocerebellum, m.o. medulla oblongata, 1.1. lateral line reflex centre.

The Cerebellum

The cerebellum is the first of the five major commisures of the embryo's brain, its function being co-ordination of the central reflexes. The most primi-

tive part of the cerebellum (fig. 7) is the archicerebellum which still retains some connection with the lateral line system.

The setup shown in the diagram persists in the case of fishes, amphibia reptiles and birds which lack the neocerebellum. The latter structure which is evolutionary more recent is found only in mammals. The archicerebellum at this stage retains its useful function as a centre of equilibrium in that it supplies the labyrinth of inner ear.

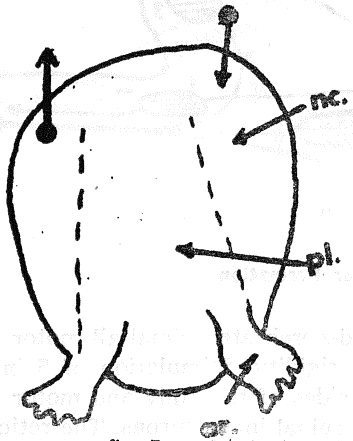


fig. 7

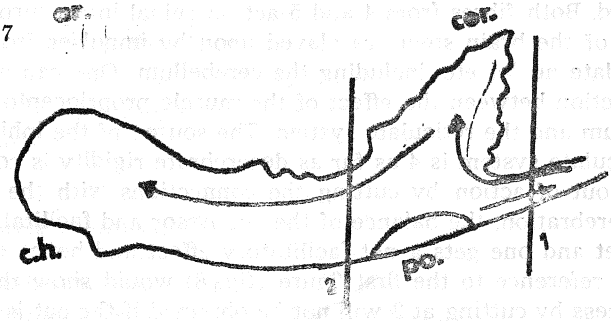


fig. 8

Guide to labelling: (fig. 7) nc. neocerebellum, pl. paleocerebellum, ar. archicerebellum. (fig. 8) c.h. cerebral hemispheres, cer. cerebellum, po. pons.

Sea-sickness pills probably act on this centre. Examine now the set-up of a cat's brain (fig. 8). If one cuts the brain at 2, the animal becomes stiff, the extensor muscles become contracted, the tail is raised and the head elavated. All these are symptoms of "decerebrate rigidity". For a good understanding of the cause of this phenomenon one would have to consider the reticulate system

(reticulate formation) of the mammalian brain. The work of Magoun at al. has shown this to be made up of scattered grey matter intersected by fibres running in all directions.

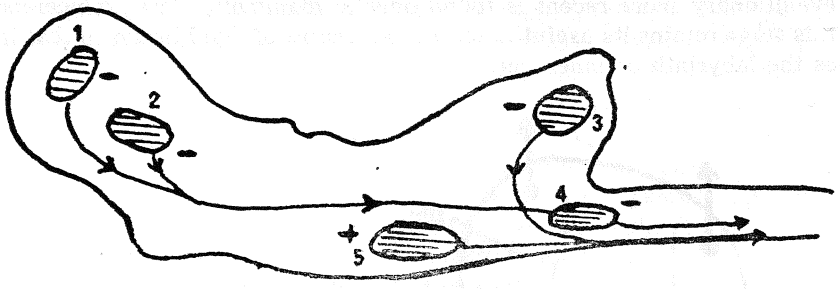


fig. 9

The Reticular Formation

When area 4 is stimulated in a decerebrate animal all motor activity is abolished and one gets a decrease in rigidity. Stimulation of 5 in a normal animal facilitates movements on both sides of the body and motor activity is aided. Both fibres from 4 and 5 act on spinal interneurons. The reticular neurons of the brain stem are played upon by impulses from the cerebral cortex, caudate nuclei etc. including the cerebellum. One can now understand the interaction between the effect of the muscle proprioceptor impulses at the cerebellum and the reticulate system. The source of the inhibitory impulses on the reticulate system is 4 as far as decerebrate rigidity is concerned. When this is put out of action by cutting the connections with the rest of the system by decerebration, the balance of the suppresor and facilitatory reticular system is offset and one gets a net facilitatory effect and hence decerebrate rigidity. In fact reference to the first figure (fig. 8) would show that the short-circuiting process by cutting at 2 will not be obtained if the cut is made through plane 1.

The Mesencephalon (Mid-Brain)

The mid-brain includes the area above the sulcus limitans or the sensory tectum associated with the eye and derived from the embryo's second commisure and the area below the sulcus limitans or the tegmentum made up of unspecialized reticulum. Primitively, apart from functioning as optic centres, the mid-brain structures were even responsible as an association area. In fact, in fish and amphibia (fig. 10) the optic tectum is a dominant structure and is responsible for such reactions as those associated with fight or flight. Sanders has demonstrated the learning behaviour of goldfish to be entirely dependent

on the integrity of the optic tectum. In fact stimuli from the two optic lobes and olfactory regions pass through the brain (diencephalon) and go to the primary visual centre in the the tectum and in the association area. These will evoke well-coordinated responses by the motor neurons leaving the area. In fact the set-up can be summarised diagramatically by consideration of a teleost's brain mid-brain nervous system.

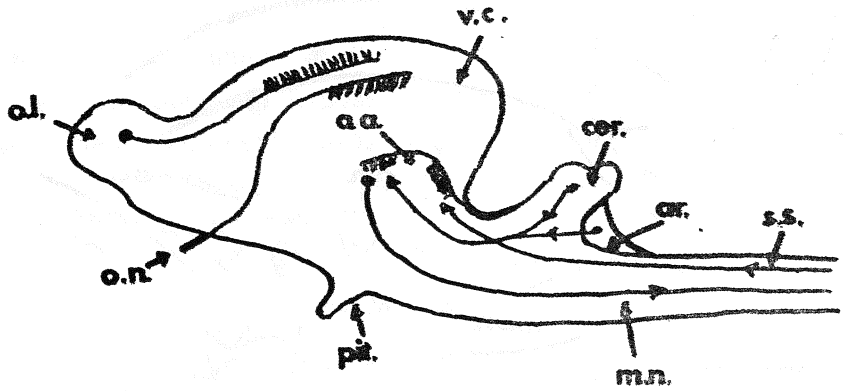


fig. 10

Teleost Brain

Guide to labelling: o.o olfactory lobe, a.a. association area, v.c. primary visual centre, cer. cerebellum, ar. archicerebellum, s.s somatic sensory m.n. motor nerves, pit. pituitary, o.n. optic nerve.

The Diencephalon (Posterior Fore-Brain)

The posterior fore-brain is made up essentially of three main parts. The dorsal region is the epithalmus or the third commisure known as the habenular. It lies on the root of the nerve tracts leading from the olfactory lobes to the brain. The thalamus is the second region and can be considered as a relay station on the ascending sensory pathways. It is a mass of grey matter with three main nuclei which receive impulses from the hypothalamus, cerebellum and sends these impulses to the cerebral cortex. The thalamus is responsible for the sensitivity of the superficial surface of the animal e.g. tactile, painful or thermal stimuli. Pain is in fact appreciated at the thalamic level and not at the cortical level since stimulation of the cerebral cortex does not evoke pain. There is still a lot of mystery enshrouding the functions of the thalamus. The final structure contributing to the diencephalon is the hypothalamus situated as the name implies venrally in the brain. It is very important structure physio-

logically since it can be considered to be the integrator of the autonomic nervous system. The nuclei can be conveniently divided into four groups: (fig. 11) (1) Anterior hypothalmic nuclei (paraventricular and supraoptic). (2) Middle hypothalamic nuclei (tuberal, dorsomedial and ventromendial). (3) Posterior nuclei (posterior nuclei proper and mamillary nuclei) (4) Lateral nuclei.

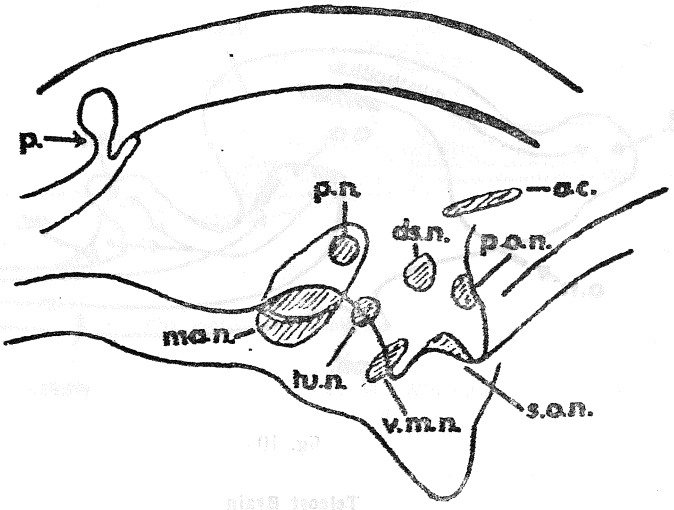


fig. 11

The Hypothalamus: Distribution of Nuclei

Guide to labelling: p. pineal organ, p.n. posterior nuclei, ds.n. dorsomedial nuclei, a.c. anterior commisure, p.o.n. preoptic nuclei, s.o.n. supraoptic nuclei. v.m.n. ventromedial hypothalamic nuclei, tu.n. tubernal nuclei, ma.n. mamillary nuclei.

Hess, by introducing electrodes into the hypothalamus of a conscious cat could evoke different reactions such as sleep, rage, hypersexuality, etc. More localised stimulation of the anterior and middle nuclei had a parasympathetic effect e.g. sweating, bladder contraction, cardiac inhibition and peristalsis of the gut. If on the other hand, the posterior and lateral nuclei are stimulated one gets piloerection, dilation of pupil, cardiac acceleration and inhibition of gut peristalsis. This shows that although the hypothalamus is not essential for sympathetic and para-sympathetic effects (a decerebrated animal from the pons retains cardiac reflexes) it comes into play under periods of stress. Moreover it is essential for body temperature regulation in homeothermic animals. In the cold, the posterior hypothalamus is responsible for vasoconstriction and shivering. The anterior, on the other hand is sensitive to a

rise in body temperature and thus causes sweating and vasodilation. On destroying the supraoptic nucleus and removing the infundibulum, ADH or vasopressin production, from the pituitary stops and one gets diabetes insipidus. At the onset of this, no water absorption takes place in the kidney tubules. The animal drinks to compensate for the large volume of water lost in the urine which may reach up to forty litres a day! The area of the supraoptic nucleus is known to secrete antidiuretic hormone since this is released when the nucleus is injected with acetylholine.

The Telencephalon

During evolution the forebrain telencephalon has developed from a primary olfactory area to the main association centre in the mammalian brain. Primitively it was an unpaired structure and later invagination caused a division of the most anterior part into two olfactory lobes. In the cyclostomes the telencephalon still retains its primitive condition in that it consists of two olfactory lobes and a paleopallium which is strictly olfactory in function. Olfac-

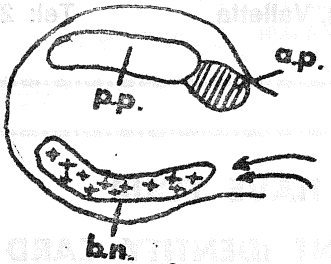


fig. 12a

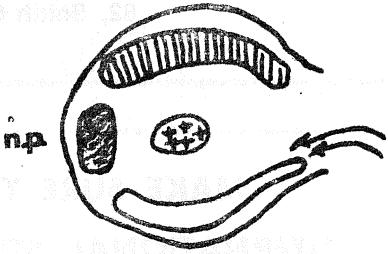


fig. 12b

Guide to labelling: p.p. paleopallium,, a.p. archipallium (hippocampus) b.n. basal nuclei (corpus striatum), n.p. neopallium.

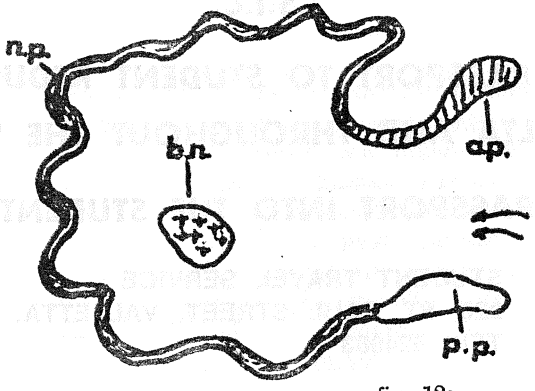


fig. 12c

tory sensations are sent along tracts through the diencephalon to be co-ordinated at other areas e.g. the cerebellum. In amphibians a new area is developed as an archipallium and a transverse section through the olfactory lobes of an amphibian will show the set-up (fig. 12a). The basal nuclei receive sensory impulses from the thalamus and this is in fact showing the beginning of a trend that is to follow. In reptiles one gets the development of the telencephalon into a correlation centre proper which gets more pronounced.

The neopallium, which is the fore-runner of the mammalian cortex is elaborated as an association centre and receives nervous connections from the thalamus region for interpretation (fig. 12b). In the mammals the neopallium expands and is elaborated into cerebral hemispheres (fig. 12c), two large correlation structures covering most of the brain; it acquires connections with the pons and the thalamus and a pyramidal tract shows up. Thus association which was primitively a function of the optic tectum (c.f. fig 10) is taken over by the neopallium or the cerebral cortex which receives optic, auditory and other impulses via the thalamus. This sensory information evokes appropriate motor response in the pons, the major motor region of the brain. The cerebral hemispheres cover the mid-brain and even part of the cerebellum (fig. 13). The cerebral cortex increases in surface area by convolution and folding of the surface. In man deeper grooves or sulci are prominent and show up as lines on the surface. These folds separate the different areas of the brain.

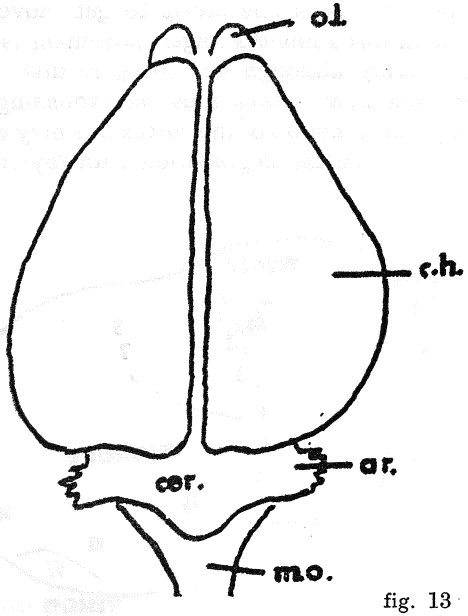


fig. 13

Guide to labelling: o.l. olfactory lobe, c.h. cerebral hemispheres, ar. archicerebellum, m.o. medulla oblongata, cer. cerebellum.

The fifth commisure of the neural crest cells in the embryo develops into the corpus callosum which bridges the two cerebral hemispheres. The main central sulcus and other important and prominent sulci enable the division of the brain into frontal lobe, pariental lobe, temporal lobe and occipital lobe. The minor sulci give the location of smaller areas knows as gyri. Histologically the cortical three layers of the embryo become differentiated into six layers of the adult.

These six layers are differentiated differently in different parts of the cerebral hemispheres and these histological studies or architectonics have enabled appropriate mapping out of the areas in the cerebral cortex and numbering of these areas as suggested by Brodman. The six histological layers are the molecular layer, the outer granular layer (small pyramidal) the medium pyramidal layer, the granular layer, the ganglionic large pyramidal layer and the polymorphous or tissiform layer. The granular layer is said to be the main arrival area of the thalamus fibres. The third layer is prominent in the frontal lobes and layer 5 or ganglionic is characteristic of the motor cortex.

In 1870, Fritsch and Hitzig applied electric stimulation to the frontal cortex and had movements of the dog on opposite sides of the body. Ferrier, a few years later tried a definite technique viz that of ablation. Removal of the area, which on stimulation gave movements of a chimpanzee's hand, made this hand go limp. This was due to lack of motor discharge from the cerebral cortex. In two or three days one starts to get movement in the proximal shoulder joints and in three months finger movement is developed. The remarable degrees of recovery although not 100% results from the acquisition of new connections from new tissues thus reestablishing the reflexes to some extent. To see the motor function of the cortex one may cut the nerve in the arm or spinal cord and trace the degradation pathway right back to the cor-

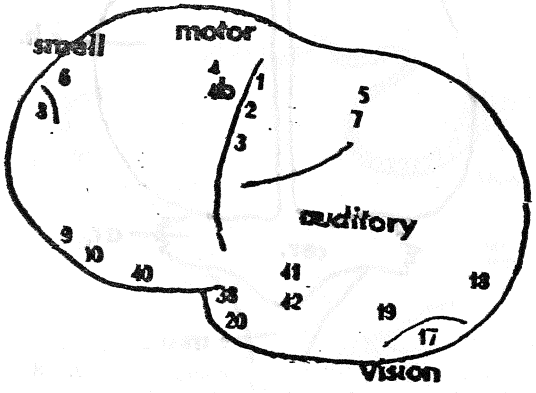


fig. 14

tex. The area in the cortex corresponding to the function usually degenerates and this can be seen by special staining (fig. 14).

Brodman's area 4 has the lowest threshold for electrical stimulation with a response in the body. In fact this is the motor cortex. Other areas do have a motor function but greater intensity of stimulation should be applid. The motor cortex is characterised histologically by having giant Betz cells, large neurons found in the V th layer associated with the large pyramidal neurons. If area 4 is exposed and a hot spatula is held longer than three seconds, all six layers of the cerebral ccrtex are killed. If only three layers are killed, one still gets motor activity displayed. The path of the Betz cell axons shows up as passing down through the pons to the pyramids where they cross over and form the pyramidal tracts. In all higher mammals, the part of the motor area near the vertex of the skull is concerned with movements of the leg, the middle part with the arms and the lowest part of area 4 with movements of the face.

A transverse secetion through the central sulcus will show up the mapping of the motor area in more detail. The problem is to what extent are the individual muscles represented in the cortex. Does every muscle have one cortical site? Ferrier found that there was considerable overlapping of areas. On stimulating the thumb area one also gets some amount of finger movement. Liddell tried to solve this problem by working on the motor cortex of *Papio papio*, the babcon. On altering the intensity of stimulation on area 4 he got a good seperation of the areas e.g. thumb, index, etc. It is believed by some that currents of suitable intensity and frequently applied to the motor cortex in man will evoke single muscle movements. Others believe that the cortex deals with co-ordinated movements. Penfield and others say that movements of cortical stimulation are quite simple and not skilled and acquired as in the adult. Area 6, (fig. 14), the premotor area of mammals lacks Betz cells and

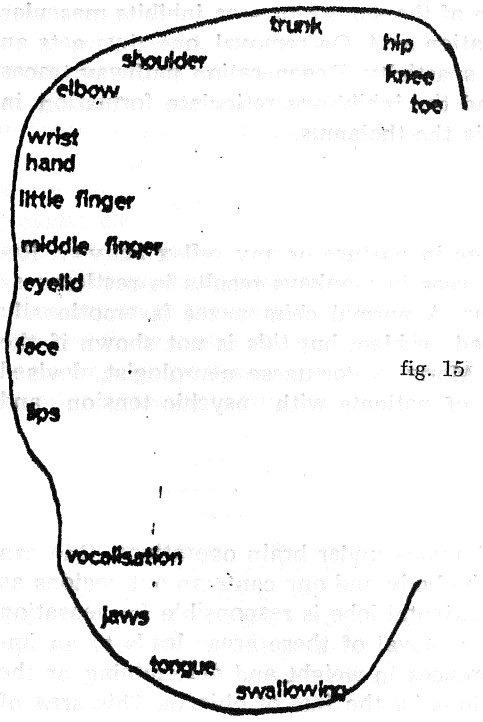


fig. 15

Motor Cortex (Man)

hence is not easily stimulated. Electrical stimulation of area 6 causes movements of groups of muscles and whole limbs. If the whole of the motor cortex of rabbit is removed, hopping and placing reactions are lost. If the area 4 in monkeys is destroyed, the animal develops hemiplagia i.e. paralysis and loss of voluntary movements on the opposite side of the body. If the pyramidal tracts in the medulla oblongata are cut, the abdomen protrudes the head sags and the limbs become flacccid. After some time sitting and walking become possible but the ability to perform accurate and delicate movements is lost. One would conclude that:

(1) Voluntary movment can be carried in fibres other than the pyramidal tracts
(2) pyramidal fibres are important in willed skilled movements
(3) most other reflexes and posture movements are under the influence of the cortex. If the ablation extends from area 4 to area 6 one gets spastic paralysis in contrast to the flacid paralysis brought by removal of area 4. In spastic paralysis one gets the arms with increased flexor tones and the legs with increased extensor tone (c.f. decerebrate rigidity).

It is found that if 4 is removed, spasticity is produced in an animal. Later it was also discovered that stimulation of the suppresor area inhibits mascular tone and movements following stimulation at 4. On removal ,one thus gets an incontrolled discharge of 4 and hence spasticity. Degeneration pathway traces has shown connections between 4 and the inhibitory reticulate formation in the brain stem and with the 4 area via the thalamus.

Frontal Association Area.

On stimulation one gets no change in posture or any reflex activity. Removal of both sides of these frontal areas in monkeys results in restlessness and defects in learning and behaviour. A normal chimpanzee is emotionally upset if he fails to solve a complicated problem but this is not shown if the front association areas are removed. Moriz, a Portugese neurologist, devised prefrontal leucotomy for treatment of patients with psychic tension and anxiety.

Sensory Areas.

This has been investigated in humans under brain operations. One can get sensations from various parts of the body and one can map out regions as for the motor cortex. The important pariental lobe is responsible for sensation of touch and pressure. Destrution or removal of these areas leads to an impairment of the ability to detect differences in weight and determining or the appreciation of form in three dimensions by the feel of objects. This area of the cortex is capable of fine descrimination of stimulus and small differences in the intensity.

Temporal Lobes

These receive impulses from the ear's cocklea. In the monkey pure tones of high frequency cause nerve discharges in the caudal part of this area and with low tones in the rostral part. In dogs three distinct areas have been traced, two capable of coarse and one of fine discrimination.

Occipital Cortex

It has for long been known that removal of the cerebral cortex was accompanied by blindness. Recently the precise area of the human occipital cortex has been localised to Brodman's area 17 (fig. 14). The path of the optic nerve fihres have been followed by degeneration pathways from the retina. Fibres from the optic nerve have been found to cross over at the optic chiasmata. The areas 18 and 19 adjacent to area 17 and association areas in which co-ordination of eye reflexes with other reflexes occurs.

The prefrontal areas in primates are large and this is associated with complex behaviour and ability of learning shown by these higher animals. The higher functions such as consciousness, intelligence and insanity are difficult to define. A stimulus which in an ordinary animal produces an activity A will after a process of learning provoke a different activity B.

So between the sensory and motor areas of the brain there must be developed a pathway of low resistance during the learning process. This need not necessarily be anatomical e.g. by growth of processes. In fact neurologists object to possibility of branching in neurons which are so densely packed.

A change in size of the synaptic knobs, in fact an increase has been proved to occur with activity. This would in fact decrease the width of the synaptic cleft and hence more acetylcholine is produced and one gets facciliation of condition.

The establishment of the pathway will be helped by the "engraving" of a memory trace which gets clearer and easier to perform with increasing use. However there is still vagueness of unscientific terms in describing these phenomena. One knows that nerve cells are dying and are being replaced contiuously and this memory trace and engraving involves more than just facilitation.

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LA "NOIA" DI UNGARETTI

Gerard Bugeja

Anche questa notte passerà

Questa solitudine in giro
titubante ombra dei fili tranviari
sull'umido asfalto

Guardo le teste dei brumisti
nel mezzo sonno
tentennare.

Per apprezzare la poesia di un poeta, lo studente deve rifarsi al clima culturale [1] ed intellettuale in cui operava lo scrittore che vuole studiare [2]. Nel caso di Ungaretti non è possibile fare a meno di un' indagine sulle maggiori correnti lettarie e filosofiche che in quel torno di tempo, cioè agli inizi del Novecento, si facevano sentire sugli intellettuali dell'epoca.

Era la Francia che nell'adolescenza di Ungaretti dettava nuove norme del fare poetico. Ungaretti stesso ci informa che "nel 1906 ... ero lettore del *Mercure de France:* era, è noto, la rivista che rivelava ogni giorno, a quei tempi, i valori nuovi, e quell' audacia sorprendeva persino gli uomini più accorti. La letture del *Mercure de France* ebbe nella mia formazione un' importanza da non trascurare. La polemica che vi si svolgeva, s'imperniava intorno al nome e all'opera di Mallarmé. Mi gettai su Mallarmé, lo lessi con passione ed, è probabile, alla lettera non lo dovevo capire; ma conta poco capire alla lettera la poesia: la sentivo, Mi seduceva con la musica delle sue parole, con il segreto, quel segreto che mi è tutt'oggi segreto. Mallarmè non mi è forse più un poeta interamente ermetico, è un poeta" [3]. Questa confessione ci permette di collegare Ungaretti con Mallarmé, che, si ricordi, è il teorico della "purezza" della poesia, della sua "parola". Infatti, nei primi prodotti letterari di Ungaretti, di cui la *Noia* sarebbe uno dei più significativi, ci si accorge del tentativo del poeta di ridare alla parola quella carica fonica e semantica che nel corso dei secoli aveva perso: il poeta del deserto è continuamente impegnato a scavare nel segreto della parola perché se ne

1. Nel senso più ampio della parola.
2. Questo mio atteggiamento storicistico non va interpretato come chiusura verso le altre correnti più moderne, come quella psicanalitica e stilistica e sociologica, di cui mi sono pur avvalso in questo mio studio.
3. G. Ungaretti, *Note del poeta sulla vita e sulla sua poesia,* in *Ungaretti,* a cura di L. Piccioni (Torino, 1971), p. 334.

sprigioni un' eco sotterranea [4]. Si notino le vocali arrotondate (o, u) della seconda strofe della *Noia:*

> Questa solitudine in giro
> titubante ombra dei fili tranviari
> sull'umido asfalto

Le vocali arrotondate, specie la velare 'u', creano, tramite la suggestione fonica, un' atmosfera di mistero e di silenzio, un sentimenti dell'inafferrabilità del passar del tempo e della angoscia esistenziale che ne deriva; paura che è tutta coagulata nella frase "titubante ombra" non solo per via semantica (il connotato di "ombra" è sempre stato uno di cosa labile, effimera, che sfocia nella morte) ma anche, e soprattutto, per via fonica (la labiale 'b' di "titubante" riecheggiata dalla 'b' di "ombra", e le pause che vengono a interporsi fra le labiali tramite i gruppi fonici 'ant' ed 'omb'). Cioè, se da un lato Ungaretti rinuncia a rima e metro tradizionali [5], dall'altro lato egli "tende a valorizzare in compenso i valori sillabici, le cellule fonico-semantiche del discorso che acquistano forza strutturante, a volte anche rispetto alle immagini o unità iconiche stesse" [6]. Proprio concentrandosi sulla pronuncia delle singole parole, egli trasmette, credo, il messaggio della *Noia* [7]. Si rilegga la terza ed ultima strofa:

> Guardo le teste dei brumisti
> nel mezzo sonno
> tentennare.

Nell'unità strofica conclusiva *brumisti* e *tentennare* riecheggiano rispettivamente *ombra* e *titubante* della seconda strofe; però, va subito notato nel primo verso della terza strofe, il prodominio delle dentali e delle sibilanti delle voci *teste* e *brumisti,* e, nei seguenti vers, delle doppie consonanti di *mezzo, sonna* e *tentennare:* queste doppie, pur nel loro ritmo pausato, accentuano il passagio da una condizione di moto chiuso e ambiguo (*titubante ombra dei fili tranviari* dove le liquide di *fili tranviari* sono incastonate tra le labiali di *titubante ombra* e di *umido*) a quello di moto possibile, un moto vitale ed effusivo. Si deve tener conto della carica di apertura che serbano le parole *sonno* e l'infinito *tentennare,* pieno questo di carica alliterativa. Pare che il poeta stesse per dire che la vita è questo prender coscienza dell'esistenza, e che questa esistenza è una resistenza, facendo valere i gruppi fonici 'ste' e 'sti' di "teste" e di "brumisti" con la loro implicazione di durevolezza [8]. E

4. Questo aspetto si può trovare nella poesia di Baudelaire. Cfr. W. Benjamin, *Angelus Novus,* (Torino, 1962), p.96.
5. Rinuncia che egli eredita dai futuristi.
6. G. Cambon, *La Poesia di Ungaretti* (Torino, 1976), p.31.
7. Per la differenza fra le prime versioni e quella finale di *Noia,* cfr. E. Sanguineti, *Fra Liberty e Crepuscolarismo* (Milano, 1965), p.110.
8. Ragion per cui G. Cambon, *op.cit.,* ritiene abbiano la stessa origine le parole come 'stone', Stein, e Stare.

questa solitudine che viene scoprendo il poeta non sarebbe più motivo di paura, ma di potenziale conforto, perchè forse inconsciamente, trova in questa solitudine la solitudine prenatale e infantile, per cui si sentiva unito al Cosmo [9]: il naufrago trova una sua allegria momentanea.

Queste nostre osservazioni di carattere stilistico e psicanaliticco ci aiutano certo ad addentrarci nella 'ragion d'esser' di questa poesia. Comunque, certe domande sul contenuto della poesia sono rimaste finora senza adeguato commento. Perchè, per esempio, il poeta esita davanti ai "fili transviari" e all "umido asfalto"? E' probabile che Ungaretti fosse in quel periodo sotto l'influenza della filosofija di Bergson. Si ricordi la distinzione che faceva il filosofo francese fra l'intelligenza e l'intuito [10]; secondo lui, l'uomo che trasforma la materia e costruisce nel tempo e nello spazio ,sarebbe sì utilissimo ma incapace di afferrare il significato della *durée*, della vita stessa. Accanto all' *homo faber* ci deve essere anche, e soprattutto, l'*homo sapiens:* questi s'addentra nella realtà della *durée* senza scomporre questa stessa realtà. Ma questo l'*homo sapiens* lo può attuare solo in alcuni momenti favorevoli e transitori [11]. Ungaretti lo realizza in quei momenti ambigui e labili dell'alba, dopo le lunghe notti che egli trascorre insonne, passeggiando fra la Senna e il giardino del "Lussemburgo" (vedi *Nostalgia*), o dopo una notte insanguinata, in trincea, come farà sul Carso (vedi *Vanità*). Qui a Milano, compone la *Noia* dopo una notte che egli trascorre passeggiando, stanco e solo, lungo i viali deserti, riflettendo probabilmente sull'inconsistenza del nuovo mondo borghese, questa nuova civiltà — con il falso mito della velocità —, di cui egli, venuto dal 'nulla' del deserto prevede già il lento ed inevitabile consumarsi [12].

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9. Gaston Bachelard, *La Poetica della Reverie* (Bari, 1972), pp.109-119.
10. J.M. Bichewski, *Contemporary European Philosophy* (Los Angeles, 1969), pp.104-105.
11. Si aggiunge a questo riguardo la pesante e negativa critica da parte dei critici marxisti di questo "l'art pour l'art", di questo slancio fine a se stesso. Cfr. R. Bodei in E. Bloch, *Karl Marx* (Bologna, 1972), p.15.
12. W. Benjamin, *op.cit.*, pp.87-151.

THE PROBLEM OF LIGHT: The First Rumblings of the Wave-Particle Duality

Albert Farrugia

Light — the physicists' problem. The nature of light was the subject of such controversy ever since two schools of thought — one led by Newton, the other by Huyghens — had proposed two different viewpoints of the nature of light. Newton viewed light as a stream of discrete particles while Huyghens maintained that light was a form of wave-motion. As any O-level student knows, experimentation involving wave-properties such as diffraction (the famous Young's slits experiments) eventually proved as correct Huyghens' idea of light as waves passing through a continium, which was eventually shown to be space itself by the Scot, James Clerk-Maxwell in his work on electro-magnetic radiation. By the end of the 19th Century, it seemed that light presented no problem. Light was waves.

The first problem that arose involved an explanation of the energy distribution of the thermal radiation emitted upon heating a perfect absorber — a perfectly black object. In practice what was studied was the radiation emitted by an enclosed cavity heated to very high temperatures. A small hole was drilled in the cavity and the thermal radiation emitted from the hole was investigated and analysed. As the temperature of such a cavity — a "black body" — is increased, the colour (i.e. the frequency) of the radiation changes from red to white in a way which is familiar:

550°C	dark red
750°C	cherry red
900°C	orange
1000°C	yellow
1200°C	white

Radiation with a broad spectrum of wavelengths is emitted and to express the changes in the radiation spectrum the function $p(V,T)$ is defined such that $p(V,T)dV$ is the radiation energy per unit volume (the "energy density") with frequencies in the range between V and $V+dV$ found in the cavity when its absolute temperature is T.

Using purely classical arguments based on the picture of radiation in the form of continuous waves, Wilhelm Wien, in 1896, proposed the following formula for the energy distribution, showing an exponential dependence of the function with temperature:

$p(V.T.) = A\ V^3 e^{BV/T}$ where A and B are constants.

Although this formula explained the properties of blackbody radiation as envinced in the spectral data known until about 1899; in that year Heinrich Rubens and Ferdinand Kurlbaum showed, by a series of spectral measurements at low radiation frequencies, that the formula broke down when it attempted to explain data involving measurements at high temperatures and low frequencies. In fact, they showed that although an exponential dependence with temperature was observed at low temperatures and high radiation frequencies, at high temperatures and low frequencies a simple dependence on temperature was observed, i.e.

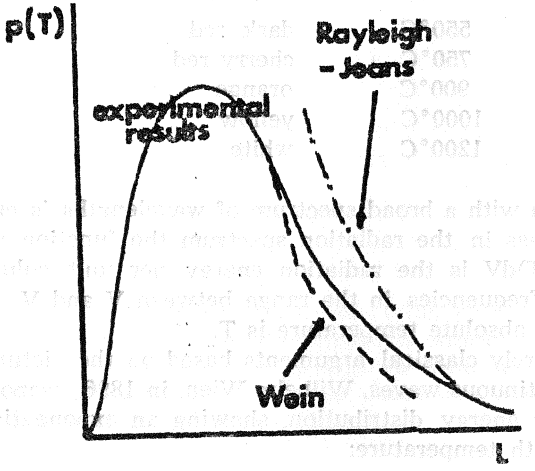
p(T) is proportional to T

It is worth noting here that these formulae, which attempted an explanation of the same natural phenomenon at two different temperature limits, are basically empirical with little theoretical foundation. The weakness of such empirical arguments is evident since even their empirical validity is dubious, as is evinced by the conflicting results at different temperatures.

The Wein formula gave good results for high radiation freqencies, i.e. for low wavelengths, but as we have seen broke down at low frequencies. At high wavelengths the formula did not fit the experimental data. Wein derived his formula by using the methods of classical thermodynamics. The problem was tackled differently by Rayleigh and Jeans. They worked out the number of modes of vibration of electrodynamic waves in an enclosure, and assumed that the total energy was equally distributed among these modes. This gave them the relationship:

$$p = \frac{CI}{C2}\,\frac{T}{L^4}$$ where CI and C2 are constants and L is the wavelength of the radiation.

The graph below shows the energy density plotted against the radiation wavelength using the Wein and Rayleigh-Jeans formula.



The failure of the Wein formula to predict results at high wavelengths is apparent. The Rayleigh-Jeans formula gave good results for high wavelengths but broke down when applied to low wavelengths, as can be seen by a comparision with the experimental results.

Thus we see that both these methods, which use classical theory based on radiation in the form of continuous waves, fail to give a complete explanation of the radiation emitted by the "black-body". It seemed that the established classical theories were not so complete after all. However, nobody dared question the validity of the established arguments..

This was the state of affairs when Max Planck started his work on the "black-body" problem. Planck represented the molecules of the wall of the cavity as simple harmonic "resonators" interacting with the radiation field of the "black-body". When the wall and the radiation field are in equlibrium, this simple model leads to a formula for the energy distribution as follows:

$$p\ (V.T) = (8\ \text{II}\ V^2/c^3)\ E\ (V,T)$$

where c is the speed of light and E(V, T) is the average energy of the resonators with vibration frequency V.

Using the classical thermodynamic relations for the quantities energy and entropy, Planck derived an empirical radiation formula of the form:

$p(V.T,) = AV^3\ (eBV/T - 1)$ where A and B are constants

This empirical relation was strikingly effective in predicting the new spectral data obtained by Rubens and Kurlbaum. In fact, a close scrutiny of the equation shows that when V/T becomes small i.e. at low temperatures and/or high temperatures, the equation reduces to an approximately linear temperature dependence:

$$p(V,T) \text{ approximately equal to } (A/B)V^2T$$

as observed by Rubens and Kurlbaum.

Planck then set out to make this empirical relation the basis for a fundamental radiation law. He attempted to give his empirical equation a foundation in theory so that it would be used as the basis for a general theory of radiation. It was with some initial misgivings that the fundamentally conservative Planck now discovered that, in the theoretical derivation of his empirical equation, a very revolutionary assumption had to be introduced. This was that the resonators must gain or emit energy not in a continuous range, as classical arguments and the wave theory predicted they should, but rather in the form of small, discrete units, whose energy should be proportional to the radiation frequency in accordance with the now famous equation:

$E = hV$ where h is a universal constant of nature called Planck's constant.

Planck called these small, discrete energy units "quanta". This fundamental assumption, which was inescapable if the empirical relations were to be given a foundation in theory, had enormous implications which were not realised for some time.

Upon the assumption that the energy units are proportional to the resonator frequency, the radiation formula now becomes:

$$p(V,T) = (8\,\mathrm{II}\,V^3)\,[hV/(e^{hV/kT} - 1)]$$

where k is Boltzmann's constant.

In the low-temperature, high-frequency range i.e. when V/T is large, the formula is seen to reduce to the form of Wein's radiation law, and of course this is very satisfactory:

$$p(V,T) \longrightarrow (8\mathrm{II}hv^3/c^3)e^{-hV/kT}$$

The Planck equation gives a perfect fit with the the spectral data over the whole frequency region.

As was said above, the implications of Planck's theory — that light, instead of being absorbed or emitted in the form of continuous waves, was instead a series of energy packets — were not immediately realised or accepted. However, further support for the new theory was provided in 1905 by Albert Einstein, who in that year published a series of papers that dealt death blows to classical physics. Among these was the first paper on the Special Theory of Relativity and a paper entitled *On a Heuristic Viewpoint Concerning the Production and Transformation of Light.*

In this paper Einstein took up the thesis that real quanta of energy exist and that they are to be found, as manifested by certain experiments, in the radiation field. We have mentioned the tardiness in the scientific world in fully realising the implications of Planck's theory and Planck himself was very careful not to infer anything concerning the structure of the radiation field — he restricted quantization to the behaviour of the material resonators of the "black-body". Yet here was Einstein asserting that light consists of discrete quanta (or photons as they were later known) not only in emission or absorbtion but also while travelling. It seemed a throwback to Newton's absolete theory of light as particles. It is important to note that even more than Planck's work, Einstein's reasoning was developed from fundamental assumptions with very little experimental support. To the physicists of the day, brought up on the empirical laws of Newton, such theories were highly suspect. But the experimental support for Einstein's photons assured the theory widespread acceptance. One of the mysteries that it involved was the problem of the Photo-Electric Effect.

It had been known for some time that when a metal surface is illuminated with ultraviolet light in a vacuum, an electric current is produced in

direct proportion to the intensity of the light. In 1899, Philippe Lenard had established that the current consists of electrons, previously characterised by J.J. Thomson. The electrons emitted must gain their kinetic energy from the light shining on the metal surface. Now, according to the classical wave theory of light, the energy of the incident illumination should have been proportional to its intensity — in fact to the square of the wave amplitude. One would have thus expected, from the reasoning, to observe a dependence of the kinetic energy of the emitted electrons on the strength (intensity) of the incident illumination. In short, if the light shone on the metal surface was made brighter, the emitted electrons should have moved faster.

In fact Lenard found that the *number* of emitted electrons did depend on the intensity of the light, but their *kinetic energy*, or *velocity*, was toally independent of the intensity. This did not conform to what was expected from the wave theory. Instead, the energy of the electrons was found to depend on the *frequency* of the incident radiation. Subsequent experiments showed that, whatever the light intensity, only a small time lag elapsed between illumination by the radiation and appearance of the current. This happened even with a very weak intensity and again did not fit in with the classical picture of light in the form of broad wave fronts striking the metal surfaces. Such a picture would have led to the expectation, for a weak illumination, in a time lag of several hours which would be required for the atom to absorb sufficient energy to eject an electron. Thus this phenomenon, which is known as the photo-electric effect, cannot be explained by the classical, or wave, theory of light.

Einstein, however, showed in his 1905 paper that his theoretical formulation of light as discrete particles, or photons, can explain the puzzling features of the photo-electric effect. If we view the illumination of the metal as a bombardment by the light particles, the transfer of their energy to the electrons inside the metal leads to the properties observed. Supposing the photons each have an energy $E = hV$ according to Planck's equation.

Supposing then that this energy is transferred to an electron which is then ejected from the metal surface with a certain velocity. For an electron to escape from the attraction of the atom in the bulk of the metal a certain ammount of work would have to be performed. Calling this work P and denoting the electron's mass and velocity by m and v respectively, we arrive at the following equation describing the energy balance:

$$(mv^2)/2 = hV - P$$

(kinetic energy of ejected electron) = (energy of incident photon transferred to electron) — (work performed by electron in reaching metal surface from bulk).

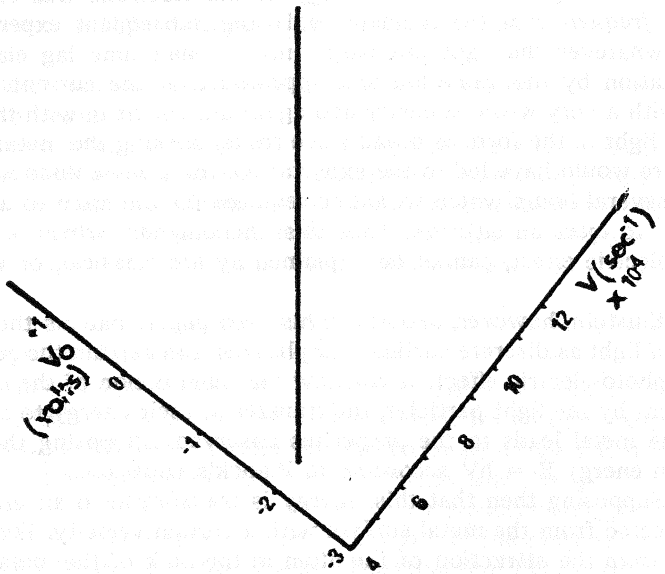
If the electric current caused by the emergent electrons is opposed by a potential just large enough to prevent the ejection of the electrons — by bal-

ancing therefore, the kinetic energy of the elecctrons with a potential V_o such that:

$$V_oe = (mv^2)/2 \qquad \text{where e is the electronic charge,}$$

then $$V_oe = hV - P.$$

Plotting V_o against V should produce a straight line graph since this equation clearly shows that V_o, which depends on the kinetic energy of the ejected electrons, is a function of the frequency of the incident light. In fact, during 1912-17, a series of experiments by Robert Millikan resulted in a beautiful confirmation of the result by Einstein's equation. Upon illuminating rodium with light of various frequencies, the following results, which are plotted below, were obtained:



It is worth noting that the series of experiments that confirmed Einstein's equation, and its theoretical foundation — the picture of light as discrete particles with energy given by Planck's equation — were initially performed in an attempt to disprove Einstein's photon theory. Such was the reluctance with which the quantum ideas finally became established.

This reluctance was understandable. One of the pillars of classical physics, the wave theory of light, had been shown to provide only an incomplete picture. Certain properties of light, such as the phenomena of "black-body" radiation and the photo-electric effect, had been shown to be explainable only by a completely new theoretical model. Light appeared to be behaving as discrete particles.

In this way the first example of the "wave-particle duality" appeared. This was to crop up again and again in the quantum theory of atomic structure. The new theory is of a high mathematical complexity but the wave-particle duality is one of its basic foundations.

But that is another story. And lest the A- level student, in his first attempt at quantum ideas, should feel a certain frustration and confusion, it is well to end this article with a quotation from Paul Dirac, one of the greatest quantum physicists:

> "I should like to suggest that one should not worry to much about ... controversy. I feel very strongly that the stage physics has reached at the present day is not the final stage. It is just one stage in the evolution of our picture of nature, and we should expect this process to continue into the future, as biological evolution continues into the future".

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ULYSSES IN DANTE AND TENNYSON

Charles Caruana Carabez

In a critical essay entitled *The Dilemma Of Tennyson* W.W. Robinson says of Tennyson's Ulysses: "... although he speaks with the accent of Tennyson, the speakers is unmistakably the Ulysses of Dante." Further on he says: "Tennyson's Ulysses is Homer's Odysseus felt through Dante" [1] Both of these statements are misleading in that they imply Tennyson's poem and its *persona* are wholly derived, a mere translation of a passage from Dante. Nothing ,in fact ,can be farther from the truth, for, although Tennyson's poem was inspired by a passage from Dante's *Divina Commedia* [2], indeed in spite of the fact that lexical elements are 'borrowed' by Tennyson from Dante, the theme of the English poem is completely different. There are, moreover, other differences apart from the thematic one which contribute towards rendering Tennyson's poem an entirely original work.

Considering the minor differences first, one should instantly realise that Dante's Ulysses is a narrator in a quasi-narrative poem, whilst Tennyson's *persona* is not. Dante's Ulysses has, as his *raison d'etre,* the telling of a story which amounts to an original version of his own death; Dante apparently desired to give Ulysses a more fitting death than the pathetic one ascribed to him by Homer. [3]

The inference to be drawn here, then, is that the culmination of Dante's passage is Ulysses's death, whilst this is not so in Tennyson, in whose poem a *future* death is merely mentioned and dismissed.

The chronological setting of both poems is also very different. In Dante, Ulysses is dead, and is describing past events, whilst in Tennyson he is debating a *future* course of action. This of course has direct bearing on the matter of tone, for whilst the Dantesque passage has a tone of narration that of Tennyson, relying as it does from the tension arising from self-debate, from the impassioned examination of a personal situation, is dramatic.

In Dante, too, the Ulyssean episode forms part of a much larger entity, the *Inferno.* Being an episode, its importance lies in relation to other episodes, and although it can be considered on its own, it has far greater meaning when considered as part of a larger pattern. Being part of a whole, it is inferior to the whole, a molecule in a sea. Tennyson's poem has impact precisely because it exists in a void. It im-

1. W.W. Robinson "The Dilemma Of Tennyson", *Critical Essays On* The Poetry Of Tennyson, ed. J. Killham (London, 1969), pp.155-6.
2. *Inferno* Canto XXVI, ll.90-142.
3. According to Homer, Ulysses was killed in error by Telegonus, his son by Circe, who was shipwrecked on Ithaca, Ulysses's island.

poses its presence upon us with the same force as Rodin's *Thinker* would project, if we were to see it as the only illuminated object in a large dark hall. This 'splendid isolation' naturally strengthens the dramatic quality issuing from the tone, and indeed makes the whole poem much more memorable and striking. What is particularly strange is that in spite of its having no kind of 'main body' to which it can be attached, it does not have the 'feel' of a fragment. It is a soliloquy which does not need a play, an island entire unto itself.

The two poets visualised the protagonist in very different ways. In Dante, Ulysses is fully identifiable, with the common attachments of common men:

> ne dolcezza di figlio, ne la pieta
> del vecchio padre, ne il debito amore
> lo qual Penelope dovea far lieta
> (ll. 94-96)

— even though Ulysses is here stating that his 'ardour' for discovering the world('divenir del mondo esperto', 1.98) was stronger than his love for his family, he acknowledges this love with adjectives which express its strength and warmth.

Tennyson's Ulysses may seem, by contrast, a much 'colder' man. He is 'match'd with an aged wife': His words express his marital relationship clearly. It is a match, a matter of convenience now rendered even more desultory and devoid of attraction by the onset of old age. As to his son, Telemachus, 'He works his work, I mine'. His relationship to his son is the same we reserve for passers-by in a busy street: We merely acknowledge their existence. His son, moreover, is described by him with condescension and even subtle contempt'[4]. He has 'slow prudence', he is enamoured of common duties, he is 'decent' and 'tender', he is meticulous in that he does not simply adore his gods but does so in 'meet' fashion. His gods are as pedestrian as he is, being but 'household' deities. Telemachus's chief aim is that of subduing people to 'the useful and the good': a glorfied chief-constable. Quite clearly, Ulysses is disdainful of a son who has not taken after him, and who does not share his vision. Ulysses is not 'cut out' to be a king, and he is attracted by his people; they are, to him,

> ..... a savage race
> That hoard, and sleep, and know not me.

Being these people's king is unpleasant since it forces him to "..... mete and dole/Unequal laws ....."

If there is nothing at home which attracts him, what does this man sigh for? Adventure certainly, as is clear from even a cursory reading of the poem. Most critics have maintained

4. I am indebted to E.J. Chiasson for his perceptive analysis of the Ulysses-Telemachus relationship in Tennyson's poem in his essay "Tennyson's *'Ulysses'* — A Re-Interpretation", J. Killham (ed.) *op. cit., p.*1.

that adventure is the mainspring of his soul, but further analysis may indicate that this is too simplistic.

Ulysses is not a lone wolf, he displays no desire to 'sail to Byzantium' on his own. His nostalgia for his mariners is sharply defined:

> ..... my mariners,
> Souls that have toil'd, and wrought and thought with me -
> That ever with a frolic welcome took
> The thunder and the sunshine and opposed
> Free hearts, free foreheads .....

Ulysses aspires for 'some work of noble note', one 'not unbecoming men that strove with Gods in the company of his mariners. The picture that emerges from a close reading is of a man who hates 'to dole unequal laws', who loves 'to strive, to seek, to find and not to yield', who has 'drunk delight of battle with (his) peers', and who dreams of a last grand 'fling' in the company of his loyal band, with him 'one equal temper of heroic hearts'.

With our legacy of historical fact we can recognise Ulysses for what he is. In the 1920's and thirties Europe brought forth the idea of the 'superman', the military athlete. Tainted as it became through the politics of Italy and Germany, the idea hardly appeals to us, yet it seems to hold a kind of fascination of its own. It is a recurrent one, since it had equal force in Sparta. During the second world war, the Teutonic expansionism of the Third Reich offered ample possibility to young men for savouring the 'heady delights' of braving danger in the company of courageous comrades. Resourceful, free-style commando warfare waged by small, self-sufficient groups of highly-trained young men actually gave Germany most of her amazingly swift early victories. These men, imbued with the idea of being supermen,, relishing a spartan life in an exclusively masculine environment, achieved feats of arms which sound impossible. Ulysses displays the love of danger and the unyielding mentality of these men. Ulysses is intense in his loyalty, in his love of equality adventure and peril. He is not a 'cold' man; he is merely excited by things which lie outside the pale.

The Ulysses of Dante's *Inferno* demonstrates characteristics which are quite different, and issue from the Italian rather than the Nordic *weltanschauung*. Although he is a brave man, he is not beckoned by danger *per se* but by the excitement of discovery: ".....l'ardore/ch'i ebbi a divenir del mondo esperto." (97-8)

He is an explorer, a geographer, not an unyielding 'striver'. Ulysses's speech in the *Inferno* is replete with geographical names: Gaeta, Spain, Morocco, Sardinia, the Antartic (L'altro polo). He is not in search of danger but dreams of a new world (diretro al sol, del mondo sanza gente). It is quite clear that Dante's Ulysses does not yearn for Valhalla: he has been spawned in the environment which brought forth Marco Polo, Christopher Columbus, Vasco da Gama, even. His talk of stars clearly places him in the tradition of these great navigators and explorers, and in fact lines 124 to 132 (inclusive) deal with navigation. This element is far less conspicuous in Tennyson. Indeed,

Dante's passage is somewhat superficial in the sense that introspection is not a major element. In Tennyson Ulysses bares his soul, and this is possible, as has been pointed out, because of the form of dramatic soliloquy which Tennyson chose. This exposure of the driving force within an identifiably 'great' man cannot but contribute to the thematic element.

In both Dante and Tennyson one detects what may be termed 'moral awareness', and this amounts to a marked similarity. Both *personae* regard the ennobling of human nature through trial as being most important.

Dante's Ulysses tells his men: "fatti non foste a vivere come bruti," and Tennyson describes the common people, who do not have Ulysses's sense of challenge as 'savages' (1.4) and as a 'rugged people' (1.38). In both poems we find the desire to exceed human limitations:

> quando venimmo a quella foce stretta
> dov'Ercule segno' u suoi riguardi
> accio che l'uom piu oltre non si
> metta (107-109)

(When we came to the strait and narrow passage where Hercules did mark his limits beyond which no man may go)

> And this gray spirit yearing in desire
> To follow knowledge like a sinking
> star,
> Beyond the utmost bound of human
> thought' (30-32)

In spite of this similarity, which extends even to linguistic levels, the accent in Tennyson is on different things. His Ulysses is, as we have seen, a warrior-adventurer, and there is nothing submissive about him. Whilst Dante's Ulysses seems to acknowledge (and thereby accept) the supremacy of the gods (com' altri piacque (1.141)), Tennyson's Ulysses thinks nothing of opposing the deities (Not unbecoming men that strove with Gods (1.53)). This 'healthy' disrespect, this arrogant trust in human possibilities is akin to the Medieval concept of *virtù* [5], but at the same time is reminiscent of the aggressive attitued of the Victorian merchant and Industrialist classes.

Although Tennyson's Ulysses is a thinker (the poem is a ruminative and reflective one) he desires to 'drink life to the lees'; he is a thirster after experience, but the experience he seeks must be exotic.

This, perhaps, is the central idea of the poem. One must live, live to the full, feel life through every pore. There must be danger, bravery, willpower, loyalty and a sense of challenge if man is to deserve his name. Life has to have heroic proportions if it is to have true significance.

As such, the poem is a pagan hymn to life : it ignores any conception of punishment or reward beyond death, and considers the excitement of a 'Ulyssean' life as reward in itself. Written as it was in the poet's worst moments of bereavement it constitutes an attempted establishment of values, wherein 'living to the full' becomes supreme since death is the absolute cessation of existence. The

5. It is ironic that Dante mentions this very word (1.120).

poem has a great sense of urgency.

Tennyson and Dante were both attracted and inspired by the figure of the aged Ulysses, but their creations are basically different since they reflect their creators. Dante was troubled by the fact that the world was not completely known, as Tennyson was troubled by Death. This is why Dante's vision is of a man in search of geographic erudition, an explorer, a transformer of the unknown into the known, whilst Tennyson's protagonist is an athlete, a man who is driven 'To strive, to seek, to find, and not to yield'.

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TURNING THE BLUE INTO BLACK: The Mediterranean Oil Pollution Problem

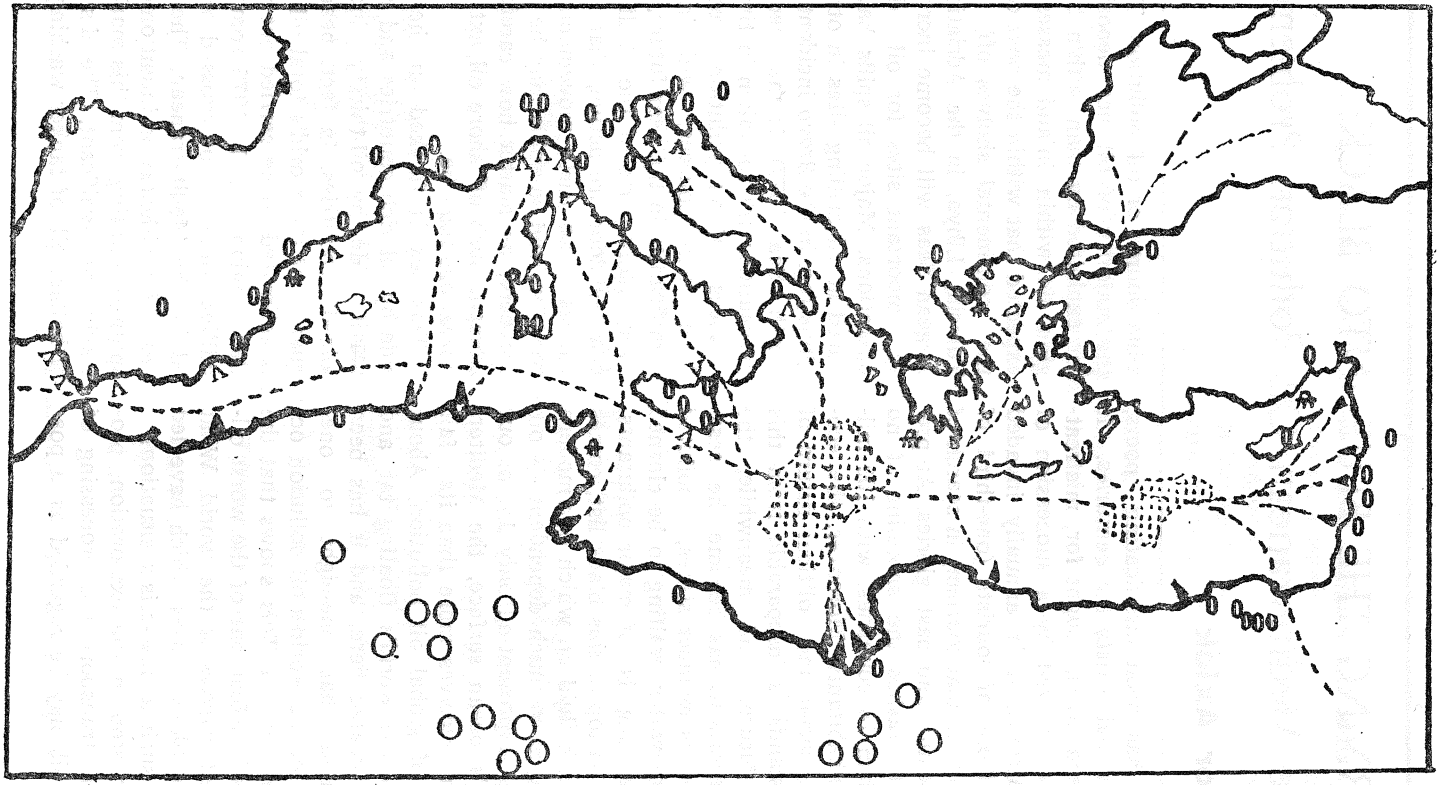
Victor Axiak

It has been intoxicating poets, writers and artists for centuries. It has been loved, fought for, mistreated and enjoyed by a succession of civilizations. It is annually invaded by millions of tourists (one-third of all international tourism) in search of fun, beauty and past glories. At present it washes the shoreline of no less than 18 countries, with 100 million inhabitants. Moreover, the economic, social and political future of our islands is inseparable from this sea's future. And meanwhile, the Mediterranean has become the cesspool of its member states, a polluted body of water, waiting to be cleaned from a long list of major pollutants. Right on top of this black list, comes that dark fluid on which our modern society is so much dependent — oil. Though representing only 1% of our planet's ocean surface, the Mediterranean receives more than its fair share of global oil pollution. About half of the world's floating tar and oil is located here, and it has been estimated that one-eight to one-fourth of the world's oil pollution occurs in this sea. This shows that the area is in effect one of the worst oil-polluted regions of the world. What are the likely causes which have led us to such a near-crisis situation?

Each step in the exploration, production, transport and processing of crude oil may be regarded as a possible source of oil pollution. Though the majority of oil rich deposits so far exploited by man within this region, lie within inland masses, it is expected that within the next decade, the continental shelves off Spain, Tunisia, Libya, in the Adriatic, and Aegean Seas will become increasingly important sites for oil drilling operations. Major oil spills have occured at oil drilling sites in other regions (eg. in the *Bravo* incident in the North Sea, 1977). If the necessary precautions are not taken in time, the chances of oil pollution resulting from such sources, will increase significantly in the near future. Moreover, many parts of the Mediterranean sea floor are active, that is, volcanoes and earth movements are common, and so spills may be expected here, no matter how careful and efficient such off shore oil extraction operations may be.

This sea is flanked on the south side by oil rich countries and on the north side by oil-thirsty industrialized countries. In fact, nearly a quarter of the world's total oil traffic is estimated to be carried out within this region [2,3]. In 1975 some 350 million tonnes of oil crossed or landed in the Mediterranean. The chances of accidental or intentional oil spillage resulting from this marine oil traffic are significant. The discharge of ballast oil, of tanker washings and

PRODUCTION AND TRANSPORT OF OIL IN THE MEDITERRANEAN SEA
(Adapted from 'Le Bassin Mediterranéan," UNEP 1977)



of oily bilge water from tankers, is in fact one of the major source of oil pollution in the Mediterranean, resulting in the annual discharge of about 300,000 tonnes of oil in this sea (1972 estimate). In order to maintain adequate manouverability and propeller immersion, tankers have to load in sea water instead of crude oil in their storage tanks, during the return voyage. This ballast water, which becomes heavily polluted with oil remains in the tanks, has to be eventually unloaded, either in the sea, or in tank cleaning facilities at harbours (only about half of the 17 loading harbours have such faclities in the Mediterranean). Some 80% of the world's tanker fleet practise a procedure called 'Load on Top' (LOT) whereby oil is separated and collected from ballast sea water before its discharge. Unfortunately such procedures are rather lengthy and are only feasible when long distance journeys are involved. This LOT system cannot be used in the short distance shipping characteristic of the Mediterranean. Until recently, in fact, most ships discharged their ballast oil in one of two regions (see map) where such discharges were permitted by international law. Since January 1978 these two dumping zones have also been removed.

Only a small percentage of oil introduced in the marine environment is actually due to accidental damage to tankers. Nevertheless, accidents do happen and these were the cause of well publicised major oil spills which occurred in several parts of the world, especially in regions of heavy tanker traffic. In the Mediterranean, one of the regions of heaviest tanker traffic is probably to the southwest of Malta. The chances of major accidental oil spills occurring in this area are uncomfortably high. The likely effects of such major oil spills would be catastrophic both to our natural marine environment and to our tourist industry.

The oil refineries lining the Mediterranian coastline utilize large quantities of water during their normal processing of crude oil. Such water effluents may contain as much as 250 parts per million of dissolved oil and this is eventually dumped in the sea. About 20,000 tons of oil reach the Mediterranean annually via these sources [4]. Loss of oil from industrial complexes along the coast, as well as from small consumers such as yachts and other water crafts, may also contribute to such land-based oil discharges. These discharges, together with those due to trasportation are the major sources of oil pollution in our sea, leading to the familiar shorelines full of unpleasant tarry residues.

The situation is worsened by the peculiar hydrographic characteristics of this sea. The Mediterranean contains some 3.7 million cubic kilometres of sea water, which is usually well oxygenated, but rather poor in nutrients such as nitrates, phosphates and silicates, needed by marine organisms. This has led some scientists to refer to this sea as 'blue but sterile' since low nutrients necessarily mean less fish and other marine life. In fact only areas under the Arctic ice and in the desert — like central and subtropical seas of the world's oceans are less productive per unit area [5]. Due to the high temperature of its surface waters, an

average of about 1.5 metres of water per year over the whole sea are lost through evaporation. To compensate for this loss, surface waters from the Atlantic (poor in nutrients) pour in the Mediterranean basin via the straits of Gibraltar. In effect, this means that the Mediterranean is replenished at a low rate and it takes 80 to 100 years to renew its water. This also means that any floating pollutant, like oil, tends to accumulate within this region and that dispersal of other pollutants is low. Moreover, cyclonic circulation of the surface waters is such that it tends to deposit any spilled oil on the shores or to accumulate it at certain exposed zones. In the Mediterranean, the deep waters are dependent for their oxygen supply on vertical mixing with surface waters mainly in three restricted regions — ie, the Provencal basin, the Northern Adriatic and the Aegean Sea. This means that the bottom sediments in such regions may well become polluted with crude oil floating on the surface. It has also been suggested that the oxygen content of the deep waters may diminish because of lack of oxygenation of surface waters due to the presence of oil slicks, though scientists seem to disagree about the validity of this argument [5, 6].

Crude oil itself is one of the most complex natural materials. Its chemical composition, physical properties and behaviour after being split, depends much on its source of origin. On spillage oil tends to spread over the water forming oil slicks. It will then start losing its more volatile and more toxic components via evaporation as well as solution in the water column. These volatile components include the lower aromatic and alkane hydrocarbons. Most of the dispersed oil is eventually removed from the sea by bacterial action. Reports have been made of widespread occurence of bacteria able to degrade oil at sea. However for such biodegradation to take place, large amounts of oxygen (1 litre of crude oil requiring all the dissolved oxygen in 320,000 litres of sea water) as well as the necessary nutrients must be present in the sea. Eventually split oil, after loosing its volatile constituents and after being partly biodegraded, will form tarry lumps which may eventually reach the coastline. such tar balls are persistent and highly resistant to further physical or biochemical degradation. The majority of beaches and harbours in the western Mediterranean are moderately or severely polluted with such tarry lumps. In some parts, fishing nets could no longer be used as they have become completely covered with tar [4].

The introduction of oil in the marine environment may have diverse and complex effects on sea life. These effects may be immediate and rather dramatic, or longterm and more subtle. The immediate toxic effects of fresh crude oil on various marine organisms have been well documented in the past few years [7, 8]. In general the greater the dispersion and emulsion of crude oil, the more evident are its toxic effects. These effects are especially significant on the coastline, where nearly all marine organisms are effected to varying extents. Young forms of marine animals are generally sensitive to oil. Thus Allen [9] has shown

that 0.5 ml of crude oil in 1ml of sea water will produce enough water soluble fractions to effect drastically, the cleavage and further development of fertilized eggs of sea urchins. Similar effects are reported in the case of many fish. Mechanical damage by crude oil on several organisms has also been extensively reported, especially on sea birds. Feathers have a great affinity for oil and oil penetrates or clogs the plumage, allowing water to enter the air spaces. As a result the bird gets heavier, swimming is impeded and flight becomes impossible. Large numbers of sea birds have died from drowning or exposure after encountering an oil slick. Also oiled birds' eggs usually fail to hatch. Oil may also penetrate into sea plants killing their growing points. However most oiled algae and seaweeds are capable of recovery.

In the presence of chronic low level oil pollution (such as is often the case in the Mediterranean) several long term subtle sublethal effects on sea life are reported, which may lead to more far reaching ecological damage. Thus respiratory functions of fish, and shellfish are effected even by very low concentrations of oil. Fish gills are irritated by dispersed oil and secrete copious thick mucus which may interfere with their normal functioning leading to sickness, unbalance in the body water and salts and eventual death. During stormy weather or when an oil slick is treated with detergents, small oil droplets are formed which may be ingested by filter-feeding marine organisms such as mollusces, leading to tainting. Fish are also known to be thus effected and reports of inedible oil-tainted fish caught in and around the Mediterranean harbours are common. In France, Spain, Tunisia Yugoslavia and Israel, commercial fish and shell fish tainted with oil are becoming a common occurrence. Furthermore it is now known that several oil fractions are chemically quite stable and may persist and become incorporated in marine food webs, possibly leading up to man himself. It is known that crude and refined oils contain many compounds which are carcinogenic to mammals or man, including polynuclear aromatic hydrocarbons (PNAH). It is as yet unclear whether such dangerous compounds are in fact incorporated and accumulated in marine food webs. Other sublethal effects of oil on marine organisms may include interference with subtle integrative mechanisms utilizing pheromones (chemical messengers), by blocking body receptors or by mimicking natural stimuli.

Recent research carried out at the University of Malta show that on exposure to water soluble fractions of oil, there occurs a reduction in the adhesive properties of tube feet and a decrease in the normal spine reaction response to local mechancal stimuli of a local sea urchin, *Paracentrotus lividus*. Also, when the littoral snail *Monodonta turbinata* was exposed to various forms of crude oil a rather curious 'inversion effect' was reported. Animals thus effected turned upside down, stand on their shell with foot fully extended, but without attempting to righten themselves up. In the natural normal state, this snail is found grouped in clusters on exposed rocky shores, presumably as an adap-

tation to withstand heavy wave action. The normal animal also tends to make a number of excursions across the sea water level each day, so that it is alternatively immersed and emersed. All these normal behavioural patterns are severely altered in the presence of crude oil, and these effects may reduce the normal chances of survival of this species [10].

Reduced species diversity of habitats exposed to chronic low level oil pollution have been reported in several Mediterranean oil harbours and refinery sites [4]. Thus the bay of Muggia in Italy was known in the past for its extraordinary colourful diversity of animal and plant life. Ever since it became the site of a huge complex of oil refineries, only about ten marine species, which are resistant to oil are left. Any reduced species diversity of a particular habitat renders it ecologically less stable.

In an effort to clean up and control oil pollution, several methods have been devised and are employed by Mediterranean states. These include, retrieval of oil by specially designed crafts, sinking and dispersing of oil by the use of detergents. Some of these control measures may themselves be harmful to sea life, especially in the case of oil dispersants. Others merely result in a displacement of the pollutants. Much effort is being made to devise efficient and harmless control measures.

The questions now are whether the Mediterranean nations will realize in time the extent of the damage being done by oil and other pollution to this sea, and whether they are willing to forget political differences and unite in a common effort to protect their common heritage. Recent developments in regional co-operation are indeed heartening. In Barcelona, in February 1976, a Mediterranean Action Plan was devised comprisng poltical, legal, scientific and economic measures in an effort to protect this sea. This action plan which is being co-ordinated by the United Nations Environmental Programme, also involves two pilot monitoring projects: one devoted to the study of the actual state of oil pollution in the Mediterranean, while the other deals with the problems of the coastal transport of pollutants.

Several Mediterranean research centres (including one at the University of Malta) are also actively participating in this plan in an effort to study the effects of pollutants on the marine ecosystem. On the legislative side, at the Barcelona Conference, the majority of the Mediterranean states adopted a Convention on the Marine Environment as well as two protocols, including one dealing with combatting oil pollution. As a result, a Regional Oil Combating Centre was set up in Malta to facilitate co-operation in this field. In fact a major role is being played by our country in the field of international co-operation as regards such common environmental problems. At many international gatherings, it is now a common sight to see marine scientists and diplomats from Turkey and Greece and from Arab countries and Israel working side by side to help solve our sea's environmental problems, while their compatriots have been at war. Maybe, only when facing a common crisis will the

people of the Mediterranean be able to strive to make out of this sea, a clean realize their common heritage and sea of peace.

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GUIDANCE AND COUNSELLING: The Helping Relationship

Paul Peter Sultana

The words 'helping relationship' are often used by teachers, counsellors, welfare and social workers, psychotherapists and doctors to characterize their services.

No doubt the words are meaningful to their users but are they to others? The phrase a 'helping relationship' is deceptively straight-forward; most of us understand that 'helping' means aiding while 'relationship means some sort of 'bond'.

Counsellors and the helping professions (phychiatry, psychology etc), are interested in the behaviour of people — living, feeling, knowing, understanding people — and in their attitudes, motives, ideas, responses and needs. The helping persons think of individuals as people seeking to discover the substance of life in this world, seeking to feel comfortable about themselves and other people and to meet life's demands productively.

Most of us realise that a dozen different revolutions are taking place in industry, education, medicine, and science. They are profoundly affecting every field of human activity: transportation, communication, merchandizing, marketing, health, weather control, the substance and structure of work and home life. We live in a time known for its application of scientific knowledge and advanced technology. Indeed

> "The visible world is no longer a reality and the unseen world is no longer a dream" (W.B. Yeats.)

The focus, nowadays, is upon the use of automated equipment in communication, industry and education — some label our era the "computerized age". In the process man as a social animal is being forgotten; he is carried with the flow of the tide.

Society does not seem to realise the fantastic and frightening paradox it confronts. We are able to control and improve everything except the one element that may spell the doom of the human race. Huge sums of money are spent to enable people to live better and longer, to enjoy leisure and to take full advantage of brilliant technology. But whether people survive and improve depends upon the resolution of man's differences with himself and his fellow man. It is to be hoped that while man's attention is directed to the machine, changes will occur which will fundamentally enrich his relationships with his fellows.

Despite technological progress, man's essential and perenial problems remain: Who am I? How did I become the way I am? Am I normal? What is good? What is reality? Of what value is life? How can I be more productive? More sensible? Happier? Guidance and Counselling try to answer these, and other, questions.

They try to make one aware of oneself and of one's environment and so become more effective and happier in life. This service is available in many Government Schools.

What do we mean by Guidance and Counselling? Guidance is the process of helping individuals to understand themselves and their world. It is a process because guidance is not a single event but involves a series of actions or steps progressing towards a goal. By it students come to know who they are as individuals; become aware of their personal identity; perceive clearly the nature of their person, experience their world, the aggregate of surroundings and the people with whom they interact, more deeply and completely.

The purpose of guidance is to give greater self awareness to individuals who thus become more effective more productive and happier human beings.

A Guidance programme offers these services:

1. An *appraisal* service which is designed to collect, analyse and use a variety of objective and subjective personal, psychological and social date about each student for the purpose of better understanding students as well as assisting them to understand themselves.

2. An *informational* service which is designed to provide students with a greater knowledge of educational, vocational and personal-social opportunies so that they may make better informed choices and decisions in an increasingly complex society.

3. A *counselling* service which is designed to facilitate self-understanding and self-development through dyadic or small group relationships. The major focus of such relationships tends to be upon personal development and decision making that is based on self-understanding and knowledge of the environment.

4. A *planning, placement, and follow-up* service, which is designed to enhance the development of students by helping them select and utilize opportunities within the school and in the outside labour market.

Counselling is very much akin to Guidance — sometimes the meanings of the two words overlap. 'Counselling' is a word used by many to describe what they do; dictionary definitions stress advice and mental exchange of ideas. H.B. and A.C. English in a *A Comprehensive Dictionary of Psychological and Psychoanalytical Terms* define counselling as "a relationship in which one person endeavours to help another to understand and to solve his adjustment problems" — whether educational, vocational or personal. There are, however, different definitions of counselling which reflect some of the subtle differences that have been emphasized or have evolvel over the years.

The author prefers this definition of Counselling: "Counselling is an interaction process which facilitates meaningful understanding of self and environment and results in the establishment and/or clarification of goals and values for future behaviour".

The central purpose of School Counselling is to assist students to explore and understand themselves so that they can become self-directing individuals. In the security of the counselling relationship, the clients are able to explore the dynamics and interrelationships among their feelings, their values, their perceptions of others, their interpersonal relationships, their fears, and their life choices. From this exploration comes insight, self-understanding, role-clarification, planning and changes in behaviour. Many School Counsellors would agree that the desired outcome of counselling is self-realization and self-direction on the part of the student-client.

A word on confidentiality would not be amiss. School Counsellors know full well that 'confidentiality' — or professional secret — is sacred for a sound and reliable Guidance-Counselling relationship between the helper and the helped. Nothing, whatsoever, that is entrusted in full confidence is divulged by a School Counsellor.

The Guidance and Counselling Services are meant to help students in understanding the variety, depth and breadth of personal experiences, the opportunities available, and the choices open to them by helping them recognize, interpret and act upon personal strengths and resources. Their major purpose is to facilitate the personal development of students — they form the 'helping relationship' par excellence!

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'A' LEVEL ECONOMICS AND THE STUDENT

Arthur G. Clare

Every student who is studying 'A' Level subjects is expected to make careful and intelligent preparation. There are no short-cut methods to achieve this end. It is essential, for instance, to acquire first-hand knowledge of the views of the top authorities on the subjects which are being studied. A student with limited time at his disposal is allowed to be selective in his reading but this does not extend to reliance on mere notes or 'model' answers. Moreover, at this level, a student is also required to show evidence of personal thought. In other words, he must demonstrate that he is not merely learning but also thinking. This calls for a critical appreciation of the books which are being read and for reflection.

During examination time, a student must be on his guard against any form of irrelevance. It is futile for one to reproduce prepared material regardless of its relevance to the questions set. No credit is gained; much time is wasted. 'Padding' is also out. Students who try to show off their knowledge on matters other than those on which they have been asked will be penalised. Finally, failure to present one's views in a clear, logical and orderly way and failure to write legibly and in accordance with the basic rules of grammar are also failures to communicate and this weighs heavily against chances of obtaining a pass.

Evidently, the foregoing applies to all subjects and not just to Economics. The latter, however, has its own special pitfalls and to these we shall now turn.

To begin with, one must realise that Economics is not an extraordinarily difficult subject. The difference between it and other subjects is really conceptual, and the majority of students taking it are not unduly perturbed by its theoretical framework. Indeed, some students do exceptionally well, while the level of work of most of the others is creditable and attests to adequate preparation. However, since Economics is a positive science in that it avoids and discourages value-judgements, some students are apt to find it difficult to replace emotional opinions with sound logical arguments. But it is only a question of time before the adjustment is made. More serious is the tendency to treat economic 'laws' as unalterable laws of nature, whereas they should be regarded as tendencies or generalisations. Furthermore, although at times students exhibit an admirable knowledge of facts, at others they show a complete lack of understanding of the concepts underlying the 'laws'. One often comes across students who do not see the significance or application of certain principles. For example, a fundamental principle such as *diminishing returns* is sometimes treated in isola-

tion with little regard to its application to farm and factory production and to the problem of over-population. This emerges from a failure to grasp the practical importance of Economics as an aid to the understanding of human activity. When one loses sight of the realism of Economics, one begins to have doubts about the usefulness of the subject, and with doubts comes indifference. And it is this indifference which is the student's greatest drawback. Economics, therefore, must be viewed in relation to the real world, and the student must always be aware of the implication of economic theories.

Economics must also be seen as a complete entity. Sometimes students get lost in specific items and are thus not able to see the over-all pattern. In this connection, it is important to make a distinction between the long run and the short run. Students do not always make it clear whether they are discussing variations of costs with output with a fixed equipment or with all factors being variable. They often attribute a rise in costs to the law of diminishing returns and leave it at that, whereas the law relates to a specific situation in the short run only. Such carelessness is frowned upon in Economies; it is a mark of weakness. Another failing is when students try to explain the causes of a phenomenon such as Inflation in terms of one factor alone, whereas in the real world many variables play a part in the causation of an inflationary process.

Then there is the problem of over-confidence. This is best seen when students are answering multiple-choice tests. These tests, which have become an important part of 'A' Level syllabuses, involve a set of questions called 'stems' and each of these has five 'responses'. The object is for the student to tick the correct response, that is, the one that correctly applies to the question asked. Here students too often jump to the wrong conclusion after a careless weighing of the five possibilities. Further, multiple-choice tests are designed to test the student over the entire syllabus, and no student can hope to do well unless he has covered a substantial part of the set syllabus. What is equally important is that a student should be able to apply and interpret economic concepts and data, for it is this ability which examiners seek to assess in this type of test. A student has to weigh each response carefully before judging the correct answer. In Economics 'A' Level a student has to attain a minimum level of competence in both the essay paper and the multiple-choice test in order to obtain a pass mark.

What we have tried to do in this article is to put the requirements of an 'A' Level student in perspective. These must be constantly kept in mind, or, better still, nagging at his elbow. But much depends on the goodwill with which the student himself tackles his subject, for ultimately it is the student's condition, his attraction to the subject or repulsion, which will determine success or failure and for this we can offer no prescription.

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