ALBERTA UTILITIES COMMISSION

IN THE MATTER OF THE

BULL CREEK WIND PROJECT

PROCEEDING NO. 1955

STATEMENT OF Sarah Elisabeth Laurie, BMBS, CEO Waubra Foundation

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FOR KILLARNEY LAKE GROUP (KLG)

STATEMENT OF SARAH ELISABETH LAURIE

1. My name is Sarah Elisabeth Laurie, and I reside in the mid north of South Australia. I was asked to submit a statement by concerned community members who belong to the Killarney Lake Group (KLG).

2. I am a former rural general practitioner, and practiced clinical medicine in rural and remote areas after completing my undergraduate medical degree at Flinders University in 1994, a Bachelor of Medicine, and a Bachelor of Surgery (BMBS).

3. I subsequently completed postgraduate training, obtaining both a Fellowship of the Royal Australian College of General Practitioners, and a Fellowship of the Australian College of Remote and Rural Medicine.

4. I was asked to become an examiner for the Royal Australian College of General Practitioners, and did so in 2001. I was also a member of state council of the South Australian branch of the Australian Medical Association.

5. In 2002 I left clinical practice because of a serious medical illness requiring urgent surgery, and initially I retained my registration to continue clinical practice.

6. I was subsequently unable for personal health reasons to return to work as a clinical practitioner, because of a combination of health issues and extended family caring responsibilities including young children and frail elderly parents in law, so I chose not to renew my medical registration in 2006 until I was in a position to resume clinical practice.

7. I fully intend to return to clinical medicine in the future, however I am currently unregistered.

8. I have never been deregistered. Nevertheless I have been informed by a number of rural Australian residents living in the vicinity of proposed wind turbine developments that wind developer employees are saying in private meetings that I am deregistered. I am also aware that some websites acting as advocates for the wind industry, including some edited by Canadians have published misleading and defamatory material, including statements that I have been deregistered.

9. I currently work in a voluntary capacity as the CEO of the Waubra Foundation.

10. The Foundation's postal address is PO Box 7112 Banyule LPO, Victoria 3804 and my phone number is 0439 865 914.

11. The foundation was established in March 2010, by the former chairman of the National Stroke Foundation, Mr Peter Mitchell, AM, after he recognised the need for urgent research to investigate the reported adverse health effects being experienced and reported to Victorian Health authorities by residents near wind turbines at Waubra.

12. At Mr Mitchell's request, I joined the Foundation initially as Medical Director in July 2010. My title was subsequently changed to Chief Executive Officer to better reflect my role.

13. The Objectives of the Waubra Foundation are attached as Annexure 1.

14. Our current directors in addition to Mr Peter Mitchell as Chairman, and myself as CEO, include Justice Clive Tadgell, formerly a Judge of the Victorian Supreme Court, the Hon Dr Michael Wooldridge, former Federal Health Minister, Mr Tony Hodgson AM, and Ms Kathy Russell, an economist and manager in a health service, who started visiting, supporting, and advocating for sick residents impacted by industrial wind turbine developments in Victoria in **June 2008**.

15. All the directors donate their time pro bono. Our activities are completely funded by concerned citizens, mostly residing in rural areas, who are appalled at the current situation and the lack of action by all the relevant responsible authorities to address the growing public health problems associated with unsafely sited and poorly regulated noise polluting wind turbine and other developments.

16. The Waubra Foundation is frequently described in the media and by wind developers as an "anti wind" organisation, and I am personally regularly described as being "anti wind". Both assertions are untrue. For example, it is on the public record that I supported my children, then aged 4, in their march in a "Get Up rally" holding a wind turbine, supporting wind energy and action on climate change, in Adelaide in 2008.

17. The Waubra Foundation is primarily concerned about the adverse impacts of industrial noise on human health, with particular focus on sound and vibration in the infrasound and low frequency ranges, ie below 200 Hz.

18. Since we commenced our work with initial concerns about poorly sited large industrial wind turbines, we have been approached by, and provided assistance to, a range of people impacted by different sources of infrasound and low frequency sound and vibration energy in both urban and rural environments.

19. Rural noise sources have included gasfired power stations (eg Pt Campbell, Victoria, Uranquinty, NSW), mining activities (eg coal mines in the upper Hunter region, NSW) and compressors used in CSG operations (eg Tara, QLD).

20. Urban sources include the low frequency noise emissions from large compressor attached to a Veterinary Building at the University of Melbourne, which was affecting the health of some of the nearby residents living in an adjoining suburb

of Parkville. The Parkville Resident's association submitted to the Federal Senate Inquiry into the Social and Economic Impact of Rural Wind Farms, and I have attached their submission as Annexure 2.

21. As a result of my work in this area of public health, I have been asked to provide written and oral evidence at the two Australian Federal Senate inquiries, which investigated this issue of wind turbine noise, and I have also given evidence in and for other legal proceedings and parliamentary or government inquiries, both in Australia and in Canada.

22. My own interest in this little understood area of public health was first stimulated in March/April 2010 by learning about a proposed wind turbine development near my home.

23. That proposal has now been dropped by the wind developer, but my professional concern about the serious nature of the health problems, the way sick residents are being universally ignored by health, planning and noise pollution authorities, and the lack of specific scientific knowledge about safe exposure doses for certain sound frequencies remains, hence my ongoing work with the Waubra Foundation.

24. Dr Amanda Harry, a rural General Practitioner from Cornwall in the United Kingdom was the first Medical practitioner I am aware of who reported adverse health effects being experienced by neighbours to wind turbines. Dr Harry conducted a survey of her patients living near wind developments in 2003. Her study is attached as annexure 3.

25. Dr Harry's additional experience and post graduate qualifications in the fields of Ear Nose and Throat disorders, and the multidisciplinary assistance she received

from a physicist with expertise in the field of infrasound and low frequency noise, together with the seriousness of some of the reported symptoms made me very concerned after reading her study that there was indeed a real problem for some neighbours of industrial wind turbines.

26. It became clear with further reading that in the subsequent years since Dr Harry's study there had been little systematic population health data collection by clinical researchers. There was no information on the full spectrum of acoustic frequency exposures inside people's homes, and very little research about the adverse health effects of chronic exposure to this sound and vibration energy from wind turbines specifically. There were, however, plenty of adverse health reports from sick residents, including reports of home abandonment, both in Australia and internationally.

27. I resolved to do what I could to ensure such research was urgently conducted, in order to ensure that future planning decisions for the siting of wind developments were better informed by science.

28. The release by the Australian National Health and Medical Research Council's Rapid Review in July 2010 into this issue did nothing to allay my concerns, indeed a glance at the list of references in that document made me even more concerned, as there was an abundance of wind industry generated literature, some of which purported to be independent, but key authoritative documents and studies on low frequency noise, sleep deprivation at its consequences and the impacts of environmental noise were nowhere to be seen. This Rapid Review document has since been extensively criticised nationally and internationally, and the NHMRC are currently conducting another review.

29. The CEO of the NHMRC has since admitted during oral testimony on March 31st 2011 at the first Federal Senate Inquiry that *"we do not say that there are no ill effects"*, a position which the judges in a court case in Ontario agreed with in July 2011, when they found that "*This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents*"

(Environmental Review Tribunal, Case Nos.: 10-121/10-122 Erickson v. Director, Ministry of the Environment, Dated this 18th day of July, 2011 by Jerry V. DeMarco, Panel Chair and Paul Muldoon, Vice-Chair, http://www.ert.gov.on.ca/english/decisions/index.htm.)

30. It was at this time when the NHMRC released their Rapid Review in July 2010, that I was first approached by Mr Peter Mitchell to work with the organisation he had established a few months earlier, initially called the Waubra Disease Foundation, as that was the name the Victorian media were using at the time to describe the symptoms being reported by the residents.

31. When I first became aware of the proposed wind development near my own home, I also sought the advice of acousticians with experience of wind turbine noise working in Australia and internationally, in order to determine whether or not, based on current acoustic knowledge, my family and I would have a problem.

32. I learnt from them and others of acoustic research and survey work which had already been carried out in Australia, New Zealand, the US, the UK and in Europe. Those acousticians included Professor Colin Hansen, from Adelaide University, and Dr Bob Thorne, from Noise Measurement Services based in

Brisbane, also associated at the time with Massey University in New Zealand. What they told me was not reassuring.

33. I also spoke with some of the residents whom Waubra Foundation director Kathy Russell, or Dr Thorne or Professor Hansen had previously been in contact with, and I was subsequently contacted by other residents who requested I visit their communities to share my growing knowledge of the problems with them.

34. I attended the first Symposium into the Adverse Health Effects of wind turbines held in Ontario in October 2010, to learn as much as I could about the problems from other scientists, health professionals and acousticians interested in the area, and also from the sick residents who also attended this symposium from the US and Canada. My husband and neighbours funded this trip.

35. During this trip I met with numerous Canadian families, who came from Goderich, Ripley, Shelburne, Amaranth areas, who all described the identical range but individually different symptoms and health problems in the characteristic pattern of worsening with increasing exposure but improving when they moved away, to those I had been previously told about in Australia, particularly by residents at the Toora and Waubra wind developments.

36. All the residents I spoke to had the identical patterns of being symptom free prior to the start up of the adjacent wind project, subsequently developing symptoms which correlated with exposure to operating wind turbines and wind direction. Their symptoms varied between members of the same household, but the pattern was consistent in that their individual symptoms worsened over time with ongoing exposure, and improved when away from their homes.

37. Some of these Canadian families had been forced to leave their homes, and some had spent time in motels, paid for by the wind developers. Some had signed confidentiality agreements, prohibiting them from speaking publicly about their health problems. I had previously been told of this practice of silencing sick people in Australia at Toora and Waubra.

38. I also met with a public health doctor at the Grey Bruce Health Unit who had publicly expressed her concerns about what was happening to rural residents living near wind developments in Ontario, Dr Hazel Lynn. Dr Lynn chose to speak out about her concerns despite the Chief Health Officer of Ontario, Dr Arline King, issuing a report, widely used by the wind industry, which essentially denied there was any evidence of health problems from wind turbine noise.

39. Dr King has recently been subpoenaed to attend court in Ontario to explain how she came to her stated position, as it has emerged that numerous Ontario families had sent detailed reports to her department advising her of the serious nature of their health problems, and that field officers in the Ministry of the Environment, responsible for noise pollution regulation from the wind turbines, had also made their concerns clear to more senior government officials.

40. I visited Toora in South Gippsland in October 2010, and met with Dr David Iser, an experienced and highly regarded rural medical practitioner who was the first Australian medical practitioner to speak publicly of his concerns and conduct his own research locally at Toora in 2003/4, based on Dr Amanda Harry's initial survey.

41. Dr Iser first raised his concerns in 2004 about his longstanding patients' new symptoms, which coincided with the commencement of operation of the Toora

wind development, with the Victorian Government and the Victorian Health authorities. I have attached his letters to then government ministers, his survey questionnaire and other material at annexure 4.

42. It is clear from information submitted to parliamentary inquiries and from media reports out in the public domain both in Australia and internationally that the identical range of adverse health problems resulting from exposure to operating wind turbines have been reported by residents and concerned health and acoustics professionals for a number of years **prior to** my own awareness of the problems and active involvement in advocating for research, which commenced relatively recently in July 2010.

43. The wind industry and some public health academics with no clinical experience in this area, frequently assert in Australia that the symptoms being reported are caused by the "nocebo" effect, by which they mean the Waubra Foundation's ongoing community education program about the reported symptoms and problems being reported by residents impacted by infrasound and low frequency nose from a number of sources, which they also refer to as "scaremongering".

44. There is no research evidence collected from rural residents living near wind developments in Australia or anywhere else in the world to support this assertion that the symptoms reported by these sick residents living with low frequency noise pollution are themselves **caused** by knowledge about the reported health problems.

45. Professor Simon Chapman's recent "nocebo" research, widely publicised by the media and the wind industry globally, did not directly investigate the circumstances of the residents reporting the problems – rather he relied on

notoriously inaccurate wind developer complaints data, media items and senate submissions where people had disclosed their identity. This data set is flawed because in all three data set sub categories it has resulted in underreporting of the real extent of the problems. There is no substitute for a properly conducted population survey and acoustic surveys at individual wind developments, to try and get an idea of the dose of sound energy which is causing the adverse effect on sleep and health (ie the dose - response curve).

46. There is human and animal research in the fields of infrasound and low frequency noise, which provide direct empirical experimental evidence that both infrasound and low frequency noise can cause a range of physiological stress effects and symptoms, many of which are also being reported by wind turbine residents. Sound in those frequencies is now being measured inside the homes of sick people, and preliminary data is showing direct correlation between certain frequencies and specific symptoms.

47. One useful literature review detailing research into infrasound was conducted in 2001 by the United States National Institute of Environmental Health Sciences, with the title " Infrasound – Brief Review of toxicological Literature". It is attached as annexure 5. Some of the animal studies listed show evidence of a physiological stress response, although generally the doses of infrasound are higher than those extremely limited data sets of full spectrum acoustic measurements inside and outside homes at existing wind developments, but the exposure durations are very short, in comparison to living 24/7 for 25 years beside a wind turbine development. The report makes it clear that there are significant knowledge gaps with respect to chronic exposure to infrasound at lower "doses" particularly, stating: *"Examples of critical data gaps include a*

lack of high quality long-term experimental studies of infrasound, and inadequate characterization of environmental infrasound and accompanying higher frequency sound levels in community settings"

48. The second relevant literature review was conducted in 2003 by Dr Geoffrey Leventhall, for the Department of Food, Environment and Rural Affairs in the UK, with the title "Review of Published Research on Low Frequency Noise and its Affects". This review contains some very useful information about the then known physiological stress connections with low frequency noise exposure, one example given is of measured cortisol elevation in sleeping children exposed to truck low frequency noise, and confirms that wind turbines were known in 2003 to be a source of infrasound and low frequency noise. That literature review is attached as annexure 6.

49. There is also plenty of evidence that the reporting of symptoms for many residents at wind developments in Victoria such as Toora, Waubra and Cape Bridgewater **preceded the establishment of the Waubra Foundation**. In the case of Dr David Iser's patients at Toora the time elapsed is some 6 years, and similarly Dr Amanda Harry's patients in her survey from the UK, which immediately preceded Dr Iser's work.

50. With respect to the impact of the Toora wind development on its neighbours, I have been advised by Dr Iser that a number of his severely affected patients left the district, having been bought out by the wind development operator at the time.

51. These former Toora residents are now restricted from talking publicly about their health problems, because of a confidentiality clause in their agreement with the wind developer.

52. I have also been advised that some homes at Toora were relocated or bulldozed, and that in these homes, residents had reported seeing vibrations in their cups of tea and glasses of water. Acousticians I work with tell me this is evidence of sound frequencies well below 200 Hz, in the infrasound and low frequency noise ranges being present within the homes. One of the homes where this vibration was reported at Toora, was subsequently bulldozed by the wind development owner, after the home was purchased from the sick resident.

53. I was advised the law firm used by the sick residents from Toora to negotiate with the wind development owner was Slater and Gordon. The use of confidentiality agreements under these circumstances to silence sick neighbours whose properties were purchased by the wind developer was confirmed by Mr James Higgins, the General Manager of Slater and Gordon, in a letter to the Australian newspaper dated 4th May, 2012. In that letter, Mr Higgins stated the following: *"We have acted for landowners who have been affected by the operation of nearby windfarms"*. Higgins went on to state that *"Any confidentiality clauses associated with some compensation claims have not been made at our direction. Such clauses are required by the wind farm operators and are typically required in these types of settlements."*

54. I am concerned about the inevitability of serious adverse health impacts of this particular proposed Bull Creek wind development on many of the neighbours, including both wind turbine hosts and their families and children as well as non participating neighbours and their families and children, over the lifetime of the

project. This is based on my direct knowledge of the adverse sleep and other health impacts of large wind turbines sited in close proximity to homes, in similar terrain to what I understand is the terrain of the proposed Bull Creek Wind Project. These characteristic symptoms and health problems have been reported by residents publicly in the media and in formal government inquiries, and privately to me by residents from numerous wind developments both in Australia and internationally. They have also been reported to government inquiries by acousticians and health practitioners with first hand knowledge of the problems.

55. Characteristic symptoms such as the "repetitive night time waking in a panicked state" or waking up exhausted for no obvious reason, correlating with wind and weather conditions consistently observed by the resident and acousticians to correlate with this pattern of sleep disturbance, have been reported out to 10km from existing wind developments such as at Waterloo in South Australia, where the larger 3MW VESTAS V90 wind turbines have been used.

56. Community noise impact surveys have been carried out by two Australian concerned rural citizens following some disturbing results obtained from a similar population noise impact survey carried out by a Masters student from Adelaide University, Zhenhua Wang, at Waterloo.

57. Mr Wang surveyed all households within 5km of wind turbines at the Waterloo wind development, and found that over 50% of residents who responded were moderately or very affected by the wind turbine noise, with 38% stating they had adverse health effects including sleep deprivation and headaches. 75 surveys were distributed, and 48 returned, given a 64% response rate, which I am told by researchers who have published in this area that this is considered a very good response rate for this type of study.

58. Mr Wang was awarded his degree on the basis of this research, but unfortunately the original masters dissertation has not ever been made publicly available, for reasons which have never been explained to the participating residents of Waterloo by either Mr Wang or Adelaide University. The briefing summary written by Mr Wang is attached as annexure 7.

59. This study by Mr Wang is the only one of its kind in the world, which has looked at the impact of larger wind turbines such as the VESTAS 3MW on a rural population.

60. Mrs Mary Morris from Waterloo repeated Frank Wang's survey questionnaire out to 10km in the same location, and found that the adverse noise and sleep impacts for some people extended out beyond 5km to 10km.

61. Mrs Morris is a 5th generation farmer in the area and knew of people including wind turbine hosts who were reporting their health and sleep was being affected by the wind turbines at Waterloo. In particular Mrs Morris knew of people well beyond 5km who were also having problems who were not included in Mr Wang's study. Mrs Morris's survey report is attached as annexure 8.

62. Mrs Patina Schneider repeated a similar community noise impact survey out to 7.5km from 2MW wind turbines at Cullerin Range in New South Wales, and found that at that distance, after nearly four years of operation, 76% of households reported sleep disturbance due to the wind turbines (71% survey response rate). Mrs Schneider's survey report is attached as annexure 9. It is noteworthy that Professor Chapman's research noted no complaints for the Cullerin wind development, in marked comparison to the numbers of households adversely impacted by the wind turbine noise.

63. This important work by both Mrs Morris and Mrs Schneider will no doubt be dismissed by the wind industry and its advocates as biased, as both women are impacted by proposed wind developments. However they cannot be dismissed quite so easily when these surveys are considered along with the evidence from many rural residents to two Federal senate inquiries, two state inquiries (NSW and SA), the results of Frank Wang's survey, and the lack of publicly available completed and published peer reviewed university research which proves that their survey data is wrong or invalid.

64. This evidence from the residents near large wind turbines reporting sleep problems out to greater distances with larger wind turbines is supported by acoustic evidence from Professors Moller and Pedersen's peer reviewed published research paper from 2011 which demonstrated that the size of the turbine is related to the amount of low frequency noise generated, and the consequent "annoyance" for the neighbours. Acoustic engineers have historically called sleep disturbance and a range of other symptoms known by them to be associated with low frequency noise "annoyance". Professor Moller stated that *"The relative amount of low-frequency noise is higher for large turbines (2.3–3.6 MW) than for small turbines (≤ 2 MW), and the difference is statistically significant."* That paper is attached as annexure 10.

65. I have now listened to detailed symptom reports from over one hundred and twenty rural residents in Australia affected by operating wind turbines, and have a good understanding of the range of pathology, the individual variability in expression of symptoms, and the pattern of inevitable deterioration with ongoing exposure once people become sensitised to the low frequency noise component of the sound energy.

66. My knowledge has also been informed by discussions with some of the treating health practitioners, being general practitioners, sleep physicians, psychologists, occupational physicians, and researchers and acoustic colleagues working in this area internationally in both clinical practice and research, and from my knowledge of the relevant research literature.

67. The symptoms reported to me by residents exposed to wind turbines primarily include symptoms related to acute and chronic sleep deprivation and its consequences, symptoms of acute and chronic physiological and psychological stress, and symptoms of vestibular disorders.

68. US epidemiologist Professor Carl Phillips has noted the connection with stress related disorders in his peer reviewed published paper on the subject, titled "Properly Interpreting the Epidemiological Evidence about the Health Effects of Industrial wind turbines on Nearby Residents" which is attached as annexure 11.

69. In the abstract of that paper, Professor Phillips states : "*There is overwhelming evidence that wind turbines cause serious health problems in nearby residents, usually stress-disorder type diseases, at a nontrivial rate. The bulk of the evidence takes the form of thousands of adverse event reports. There is also a small amount of systematically-gathered data. The adverse event reports provide compelling evidence of the seriousness of the problems and of causation in this case because of their volume, the ease of observing exposure and outcome incidence, and case-crossover data. Proponents of turbines have sought to deny these problems by making a collection of contradictory claims including that the evidence does not "count", the outcomes are not "real" diseases, the outcomes are the victims' own fault, and that acoustical models cannot explain why there are health problems so the problems must not exist. These claims appeared to*

have swayed many non-expert observers, though they are easily debunked. Moreover, though the failure of models to explain the observed problems does not deny the problems, it does mean that we do not know what, other than kilometers of distance, could sufficiently mitigate the effects. There has been no policy analysis that justifies imposing these effects on local residents. The attempts to deny the evidence cannot be seen as honest scientific disagreement, and represent either gross incompetence or intentional bias"

70. In addition to symptoms and consequences of sleep deprivation, stress and vestibular disorders, residents also consistently report that some of their pre-existing medical and psychiatric conditions worsen with exposure to operating wind turbines, but improve when either the turbines stop turning, when the wind is in a different direction, or when they are away from their home and not exposed to other sources of infrasound and low frequency noise.

71. Given the extensive and longstanding peer reviewed published clinical research detailing the known interconnections and associations between chronic sleep deprivation, stress and numerous clinical disorders including ischemic heart disease, hypertension, diabetes, immune suppression resulting in increased infections and malignancies (cancers), depression, and anxiety, this observation of these particular preexisting symptoms and health problems worsening with exposure to wind turbine noise is not surprising to clinicians and mental health professionals when they understand the way infrasound and low frequency noise, regardless of the source of the noise, are known to affect health via the physiological and psychological stress pathways.

72. When that wind turbine related noise pollution is occurring at night, and people are reporting their sleep is disturbed, even if the precise causative low

frequencies are not known, the adverse health consequences from this widely reported sleep disturbance from exposure to operating wind turbines are well known, predictable, and inevitable. It is no surprise this is now being reflected in some of the emerging research literature and comments from acousticians doing the research and acoustic surveys where data is being collected from sick residents.

73. A relatively recent meta analysis of the impact of chronic sleep deprivation on cardiovascular disease, published in the European Heart Journal in February 2011 is attached as annexure 12. That meta analysis states "*Lack of sleep exerts deleterious effects on a variety of systems with detectable changes in metabolic, endocrine, and immune pathways. Too little or too much sleep are associated with adverse health outcomes, including total mortality, type 2 diabetes, hypertension, and respiratory disorders, obesity in both children and adults and poor self-rated health"*

74. A review of the widely damaging impact of chronic stress on health by a leading researcher in this area, Bruce McEwen, was published in the New England Journal of Medicine in 1998, and since 1998 the evidence continues to mount about the deleterious effect of chronic stress on physical and mental health and well being. That review is attached as annexure 13.

75. This characteristic pattern of symptoms varying directly with exposure to operating wind turbines is entirely consistent with reports from rural residents exposed to operating industrial wind turbines around the world, and is consistent with the recent clinical and acoustic reports from my health and acoustic professional colleagues, particularly from the following: Dr Nina Pierpont, American Paediatrician, Dr Robert McMurtry, (former Dean of the Medical and

Dental School of Western Ontario), Ms Carmen Krogh, a retired senior Pharmacist from Health Canada who has conducted extensive field research in Ontario, and acousticians such as Dr Bob Thorne, Mr Steven Cooper, Mr Rob Rand and Mr Stephen Ambrose from Maine, USA, and Mr Rick James, from Michigan.

76. Dr Bob McMurtry has published a peer reviewed paper with a proposed Case Definition, to extend the work started by our clinical colleagues Drs Harry, Iser, and Pierpont, and to take into account the additional knowledge from his interviews with many affected residents in Ontario, Canada and his experience watching their symptoms progressively deteriorate with ongoing exposure. That paper is attached at annexure 14.

77. I have learnt that what acousticians call “annoyance” medical practitioners listening to the same reported symptoms described by the residents may describe as “serious clinical pathology”, particularly in the case of sleep and stress related symptoms if the effects are cumulative. Dr Nina Pierpont also identified this issue some years earlier.

78. As medical practitioners are not acousticians it is not surprising that using terms such as “annoyance” has resulted in continuing ignorance amongst our medical colleagues about what is meant by the term “annoyance” in the acoustic research literature, if they have time to read these papers.

79. Currently, the groups of medical practitioners who may have some awareness of the problems with infrasound and low frequency noise exposure are those working in the military, the aviation industry, occupational physicians looking

after workers exposed occupationally to low frequency noise and vibration, and ear nose and throat specialists who look after patients with vestibular disorders.

80. Rural General Practitioners are the first to see these patients affected by operating wind turbines, and it is my observation that they rarely have any knowledge or specific training in this field of medicine, as it is not a core part of their work, unlike occupational physicians or ear nose and throat specialists. Rural doctors are often extremely busy, and if they are part of a large medical practice they may only see one or two patients living near wind turbines who are experiencing problems, so may be unaware of the relevant body of knowledge which does exist, even though it is limited in scope with respect to wind turbine noise specifically.

81. Closer collaboration and communication between knowledgeable and industry independent health and acoustic professionals locally and internationally, as well as the work of neurophysiologists such as Professor Alec Salt from Washington State University, is now helping to overcome these communication and conceptual barriers between acousticians and health practitioners to better understand the range and severity of health problems the residents are reporting, and their connections with exposure to operating wind turbines or other sources of infrasound and low frequency noise and vibration.

82. The evidence of the suspected direct causal relationships between specific low frequency emissions from the wind turbines and specific symptoms has recently strengthened with the case study reported by Associate Professor Con Doolan in November 2011, in a paper titled “Characterisation of noise in homes affected by wind turbine noise”.

83. Acoustic and "annoyance" data with a scale for severity of symptoms was collected from a resident and inside their home 2.5km from turbines at the Waterloo wind development in South Australia. It was found that symptoms of "annoyance" were related in time and severity to the presence and "dose" of specific low frequency sound energy present at the time the resident perceived and reported the symptoms.

84. The data collection in this case study was limited in its collection of infrasound frequencies, as it did not include frequencies between 0 – 10 Hz because the acoustic equipment used did not have that capacity to detect and record those frequencies. However with respect to the frequencies between 10 – 30 Hz, the following was stated ""*Measurements taken in a single resident's home near a wind farm show an increase in the overall mean Z (unweighted) and C weighted sound level with Annoyance rating. No increase was, however, observed in the mean A weighted sound level and this is due to the majority of the acoustic energy being contained in the lower frequencies. In particular, the energy levels within the 10-30 Hz band were observed to increase with Annoyance rating.*"

85. The resident was unaware of the acoustic emissions at the time, and so was "blinded" to the acoustic results. This study is attached as annexure 15. It is important, because it provides evidence of direct causation of specific symptoms and measure low frequency noise, with a dose response relationship emerging. Whilst it was not possible for Professor Doolan to categorically determine that the only source of that low frequency noise was the wind turbines, because the developer would not cooperate with "on off" testing, the resident was adamant that the noise they were hearing was not "the noise from the refrigerator" or "the wind in the trees" which is what the wind developer and their acousticians have

asserted. The residents are well aware of the different and new sounds in their soundscape, and what wind in the trees and the refrigerator sound like.

86. The improved understanding of the physiology behind the inner ear's response to infrasound and low frequency noise has been greatly assisted by the work of physiologist Professor Alec Salt and his colleagues from Washington State University.

87. A recent paper presented by Professor Salt in August 2012 in New York, titled "Perception-based protection from low-frequency sounds may not be enough" showed that the inner ear of mammals is much more responsive to sound frequencies below 20 Hz than previously thought, especially where there is little concurrent sound present in higher frequencies. Professor Salt has suggested that based on his research, thresholds of safe exposure for infrasound such as is emitted by industrial wind turbines may be much lower than has historically been assumed by many acousticians to be safe, based on historic perception thresholds. That paper is attached as annexure 16.

88. British acoustician Dr Malcolm Swinbanks shares Professor Salt's concerns about the inadequacy of the current perception thresholds to protect health. At the same New York Conference, Dr Swinbanks referred to a paper from Chinese researchers in 2004, demonstrating that in an experimental situation, infrasound resulted in both physiological changes (blood pressure elevation and increase in heart rate) and symptoms such as nausea, at levels which were below the current audible perception threshold used to assert that levels below that threshold were "safe" and did not cause those physiological effects. This is confirmatory experimental evidence from almost 10 years ago that these perception thresholds

were not appropriate and needed to be much lower. Both the Swinbanks paper and the Chinese research paper are attached as annexures 17 and 18.

89. An acoustic environment full of infrasound and low frequency sound energy but without much concurrent audible noise is precisely the scenario in quiet rural environments inside well insulated homes in the vicinity of wind developments with large industrial wind turbines operating. When it is also understood that infrasound and low frequency noise sound energy is far more penetrating and attenuates far more slowly than audible sound, it helps explain why some people are reporting the characteristic sleep disturbance and vibration symptoms related to infrasound and low frequency noise energy on occasions out to 10km from the nearest wind turbine.

90. One such home was measured by Australian acoustician Steven Cooper, who recorded the characteristic wind turbine acoustic signature in a home 8km from the nearest 3MW wind turbine in Waterloo in South Australia, where the residents experience some of the characteristic symptoms, including sleep disturbance. That data is at figure 10 in attachment 19, in a paper by Steven Cooper with the title : “Are wind farms too close to communities”.

91. I know the occupant of that house well. The resident in that home has changed from being an ardent wind turbine supporter, who worked on the initial wind turbine development at Waterloo, to deciding to forego the income from 6 turbines himself as he doesn’t want the symptoms for his family to worsen, and nor does he want to harm the health of his neighbours.

92. The acoustic survey performed at the home in Falmouth, Massachusetts by Robert Rand and Stephen Ambrose, and first reported in December 2011 in the

document titled “Bruce McPherson Infrasound and Low Frequency Noise Study” also provided useful information with respect to the difference in the acoustic environment inside and outside the home while the wind turbine was operating. The document is attached at annexure 20.

93. Rand and Ambrose found that taking concurrent full spectrum acoustic measurements revealed that there was far more energy in the infrasound and low frequency noise section of the sound spectra inside the home than outside, and likened the inside of the home to being like being within an acoustic drum, because of the way the lower frequencies resonated.

94. Rand and Ambrose also found, unexpectedly, that they both became ill with the identical pattern of symptoms characteristic of exposure to operating wind turbines, and had to get out of the house in order to obtain relief from the symptoms. Both took some time to recover from just three days exposure. The Falmouth resident has since abandoned her home because of deteriorating health. Rand is now sensitised, and reports the symptoms he experienced at the Shirley wind project in December 2012 in his report at annexure 23 (see below). I am aware of three other acousticians who have reported to me that they too develop the characteristic symptoms when they are doing attended measurements at existing wind developments which is creating occupational health and safety issues for them in their work.

95. Further evidence of the role of infrasound between 0 – 10 Hz may be playing in the direct generation of symptoms such as nausea and headaches has come from the results of a recent acoustic survey at the Shirley wind project, Wisconsin. There was clear evidence of infrasound at 0.7 Hz and its harmonics, emitted by the operating wind turbines, generated as the blade passes the tower, called the

"blade pass frequency". The joint report of the four acousticians, and the reports by Dr Paul Schomer and Mr Rob Rand are attached as annexures 21, 22 and 23.

96. On the basis of the data collected, four firms of acousticians including those working for wind developers and those working for sick residents as well as a very senior member of the acoustics profession in America who has worked for both wind developers and residents (Dr Paul Schomer) signed a common report, which amongst other things stated the following: "*The four investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN and infrasound as a serious issue, possibly affecting the future of the industry. It should be addressed beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies*".

97. Thus there is very recent empirical acoustic survey data, from the US and Australia, which clearly demonstrates that wind turbines emit sound in frequencies below those currently being measured by the usage of dBA, which have the potential to cause symptoms in some people, and the potential to cause harm to health from the cumulative sleep deprivation effects alone, long described as the most prevalent "annoyance" let alone symptoms induced by acute and chronic physiological or psychological stress, or vestibular disorders.

98. The current practice by wind developers and noise regulatory authorities of relying solely on dBA for noise impact predictions and noise measurements has therefore been demonstrated to be inadequate, as dBA will not measure either the infrasound frequencies (0 – 20 Hz) or low frequency noise (20 – 200 Hz), and as Associate Professor Con Doolan has shown, reported annoyance bears no

relationship to dBA, but "*the energy levels within the 10-30 Hz band were observed to increase with Annoyance rating*".

99. Both infrasound and low frequency noise frequency ranges are considered by these acousticians and others including scientists and health professionals working in the field to be implicated in directly causing the pathology and symptoms being reported by the sick residents, on the basis of current knowledge and research.

100. There is general agreement amongst acousticians, health professionals and other researchers independent of the wind industry with direct personal knowledge of the problems reported by the residents that further multidisciplinary research is urgently required in order to determine human safety dose response curves, both for acute short term exposures and longer term exposures relating to infrasound, low frequency noise and vibration emissions from these wind turbines. This is particularly important given the reported and observed deterioration of the physical and mental health of residents with ongoing exposure to operating wind turbines, once they have developed initial symptoms of exposure.

101. This deterioration in health with ongoing exposure to infrasound and low frequency noise has been reported for 10 years. It was noted by Dr Leventhall, in his previously mentioned 2003 report to the UK Government's DEFRA (annexure 6).

102. On page 60, in his concluding remarks, Leventhall stated "*There is no doubt that some humans exposed to infrasound experience abnormal ear, CNS (central nervous system) and resonance induced symptoms that are real and stressful. If this is not recognised by investigators or their treating physicians, and properly*

addressed with understanding and sympathy, a psychological reaction will follow and the patient's problems will be compounded. Most subjects may be reassured that there will be no serious consequences to their health from infrasound exposure, and if further exposure is avoided they may expect to become symptom free." For residents living near existing wind developments who become sensitised, they are faced with a stark choice. Either move, or try and ensure the turbines are shut down, in order to protect themselves from further deterioration in their health.

103. Evidence showing the deterioration in people's health over time by comparing pre exposure status with post exposure status has not yet been collected in a systematic way at any wind development, so there is little comparative data, with the exception of Dr Nina Pierpont's peer reviewed study, which clearly showed deterioration in those residents, which ceased when they removed themselves from exposure by leaving their homes.

104. The Waubra Foundation urged staff in the Victorian Department of Health to start collecting this pre exposure health data prior to Hepburn Wind's turbines commencing operation at Leonard's Hill, and subsequently from AGL/Meridian Energy's Macarthur wind development turbines commencing operation recently, but according to the residents the Victorian Department of Health have not done so. Some residents are ensuring their own family doctor does a thorough pre construction health check, documenting their health status prior to the start up of the wind project in their area.

105. Residents at both these newer wind developments have publicly and privately reported serious health problems and some have reported temporary (in the case

of Macarthur) or even permanent home abandonment (in the case of Hepburn Wind) for symptom relief.

106. The wind turbines at Macarthur are the largest in Australia, being VESTAS V112's, and are not yet properly commissioned. Yet already the characteristic symptoms of the typical repetitive sleep disturbance and body vibrations, have been reported to me by families who live out to six kilometres away from the nearest wind turbine, some of whom have also spoken out in the media. For some, the symptoms started within days of first being exposed, consistent with the reports from residents and other clinicians from elsewhere in Australia and internationally. The terrain of the Macarthur wind development appears similar to the terrain at the proposed Bull Creek wind project.

107. Dr Bob Thorne's recent self-funded study submitted to both the recent Federal Senate inquiry into proposed legislation to better regulate "excessive noise from wind farms" and for peer review prior to publication in an international journal, has provided vital information about the health status of individuals who have lived near 2 Victorian wind developments for over two years. Some of those individuals were forced to leave their homes, some permanently, because of the seriousness of the health problems, which they developed with exposure to operating wind turbines.

108. Dr Thorne's study is unique, in that it combined acoustic measurements at certain homes, with collection of clinical data using standardised validated questionnaires. This had not been done previously, and gives some idea of acoustic exposures inside the homes, however Dr Thorne was unable to collect frequencies down to the blade pass frequency level such as were collected in the Wisconsin study.

109. The questionnaires chosen by Dr Thorne were based on those used in two previous peer reviewed published studies, being work of Dr Daniel Shepherd et al, published in October 2011, and Dr Michael Nissenbaum et al, published in October 2012, attached as annexures 24 and 25.

110. Dr Thorne's data confirmed the previous findings from both studies above with respect to the existence of significantly disturbed sleep in neighbouring residents, using an internationally recognised sleep quality questionnaire called the Pittsburgh Sleep Quality Index. Dr Thorne's study is attached, at annexure 26.

111. Dr Thorne's results replicated Dr Nissenbaum's findings of mental health problems in residents exposed to wind turbines. The scores were extremely low, indicating that in these people, there was a very disturbing level of mental health pathology, which is precisely what the residents have been reporting themselves. The wind turbines in all three studies mentioned above were much smaller than the 3MW wind turbines being used at Macarthur and Waterloo, so it is to be expected that the distance of reported adverse health and sleep effects on neighbours will be reduced.

112. In addition, when the health of individuals in Dr Thorne's recent case series exposed to wind turbines was compared to data collected from patients hospitalised for depression, the self reported health data of the turbine exposed group was noticeably worse on every indicator of health, including domains of physical, mental, social and environmental.

113. Hospital inpatients generally have the worst scores on these indicators, indicating the seriousness of the pathology being experienced by these wind turbine

exposed residents, which is consistent with their adverse health event reports and the reports of their clinicians.

114. The pattern of onset of symptoms is variable for each individual, even within the same household with apparently similar exposures. Reports of changes in their health from rural families in Australia to me directly are consistent with the clinical findings of medical practitioners such as Dr Nina Pierpont (USA), Dr Amanda Harry (UK) and Dr McMurtry (Canada). This is to be expected with any disease process in a population, but also because of the known individual variation with respect to perception of sound.

115. Predictors of increased risk of developing symptoms with exposure to operating wind turbines were identified by American Paediatrician Dr Nina Pierpont in her peer reviewed, case series, cross over study published in 2009. Dr Pierpont collected data documenting health status and medical problems for individuals prior to exposure to operating wind turbines, followed by a detailed clinical history of symptoms while exposed, followed by a detailed clinical history of symptoms when people reduced their exposure to operating wind turbines by leaving their homes. A clear pattern of symptoms relating to exposure to operating wind turbines was evident.

116. The predisposing risk factors identified by Dr Pierpont include having a pre existing problem with motion sickness, inner ear pathology, or a clinical history of migraines. The elderly and the very young appear also appear to be more vulnerable to developing symptoms early. Dr Pierpont's findings are consistent with the clinical reports I have been given by Australian residents, and invariably those who reported a rapid onset of symptoms with early exposure fitted into one

of the five groups mentioned above (child, elderly, motion sickness, migraines or inner ear pathology).

117. Dr Geoffrey Leventhall, the acoustic consultant often used by the wind industry, has acknowledged Dr Pierpont's contribution in this area of identifying people susceptible to the effects of "environmental noise" whilst giving evidence under oath in Canada (personal communication with Eric Gillespie, Ontario Lawyer).

118. One of Dr Nina Pierpont's Peer Reviewers for her study was Dr Owen Black, a senior Otolaryngologist (Ear Nose and Throat Specialist) with extensive experience of treating vestibular disorders and knowledge of pathology related to low frequency noise exposure from his work with the American Navy and with NASA. Dr Owen Black's affidavit for a court case from 2009 in the USA is attached as annexure 27.

119. Over time with ongoing exposure to operating wind turbines and the infrasound and low frequency noise emissions, the symptoms worsen in each individual. This worsening of symptoms with ongoing exposure to low frequency noise, was also reported by Dr Geoffrey Leventhall, in his report to the UK Department of Environment Food, and Rural Affairs, in 2003.

120. There is no evidence that people habituate or "get used to" the effects, rather the clinical evidence is that people do not habituate, and they deteriorate until they remove themselves from exposure after which many of their symptoms and health problems start to improve. This is consistent with the pattern identified by multiple clinicians and acousticians previously mentioned.

121. It is consistently reported by the residents that the longer the period of exposure, the longer it takes for their symptoms to improve with cessation of exposure.

122. By far the most commonly reported problem by the residents is repetitive sleep disturbance, resulting in cumulative sleep deprivation and consequent exhaustion with ongoing exposure to operating wind turbines. The significance of this problem has been confirmed in the peer reviewed published studies of Dr Daniel Shepherd, and Dr Michael Nissenbaum, and in the recently completed study of residents at two Victorian wind developments by Dr Bob Thorne, previously mentioned.

123. The sleep disturbance can be many times in the same night, and is reported by the residents to be related to wind direction, with the worst experiences being reported to be when the residents are downwind from the operating wind turbines, and particularly bad in certain homes on those nights where they are downwind of a line of wind turbines.

124. Some residents also report experiencing an effect when they are upwind from the wind turbines. Acoustic field measurements performed by Mr Steven Cooper have confirmed the presence of the characteristic wind turbine signature with infrasound and low frequency noise components upwind of the turbines.

125. Many residents report not being able to see or hear the wind turbines when they wake up with the characteristic symptoms, especially if they are at a considerable distance from the wind turbines. However in my experience from staying and visiting these people, their predictions from inside their homes, about turbine operation and even wind direction, solely on the basis of the symptoms they have at a particular time, when they cannot see or hear the turbines, are remarkably accurate.

126. Some residents report being woken by the audible wind turbine noise on occasions, particularly on nights with cold night air, which acousticians report is consistent with what they describe as the "temperature inversion effect" where audible noise in quiet rural areas is noted by residents to travel for greater distances and to be noticeably louder, especially if there is wind at the hub height, but little wind at the "receptor locations", also known as resident's homes.

127. I am aware that the World Health Organisation recognises sleep disturbance as an adverse health effect. In its Night-time noise guidelines for Europe (2009) it states at pXII that "*sleep is a biological necessity and disturbed sleep is associated with a number of adverse impacts on health"*. The guidelines go on to state that: "*While noise-induced sleep disturbance is viewed as a health problem in itself (environmental insomnia), it also leads to further consequences for health and wellbeing"*. One example of a consequence is the previously mentioned links between cardiovascular disease and chronic sleep deprivation, which were confirmed by Professor Capuccio's meta analysis, previously mentioned and attached as annexure 12.

128. The Federal Senate of the Australian Commonwealth Parliament made numerous recommendations in June 2011 for urgent multidisciplinary research to be conducted into wind turbine noise and adverse health effects, which included the measurement of sound frequencies inside affected resident's homes. Unfortunately with the exception of work done by Professors Doolan and Hansen, and Dr Bob Thorne no other formal academic research has taken place, two years after the recommendations were made.

129. The Waubra foundation has long advocated that a precautionary distance of 10km must be adopted for new turbine developments, especially those planning to use the larger wind turbines, on the basis of clinical reports of sleep deprivation out to that distance at existing wind developments, until this research is conducted. Our Explicit Cautionary Notice is attached at annexure 28.

130. The evidence since we issued our Explicit Cautionary Notice in June 2011 has continued to mount that there are serious concerns, and that infrasound and low frequency noise are implicated directly in causation of these health problems.

131. In May 2012 the Waubra Foundation called for the full acoustic spectrum to be measured at all wind developments, with our Acoustic Pollution Guideline Requirements document attached as annexure 29.

132. The recent findings in Australia at Waterloo and the United States at the Shirley wind project now make that imperative at all existing and future wind developments, as part of ongoing monitoring in addition to the required research. It is our firm position that such acoustic monitoring results must be mandatory, transparent, out in the public domain, and available in real time to all parties.

133. I believe that the research recommended by the Australian Federal Senate in June 2011 must be performed before any more turbines are constructed within 10km of human habitation.

134. I have not found any scientific or other evidence to show that a 2 km turbine setback from homes, such as currently exists in Victoria, is enough to protect people from low frequency noise and infrasound, especially from the larger wind turbines increasingly being used by the wind industry, indeed experienced acousticians such as Professor Phillip Dickinson with nearly 60 years experience

have suggested 5 – 10 km would be more appropriate. He stated at the conclusion of a recent paper which heavily criticised the New Zealand standard and restated the importance of sleep, *"One easy solution for solving the noise problem and protecting public health, is a ruling that no wind farm sound emission shall exceed 30 dB ($L_{Aeq,10mins}$) at any residence, nor exceed 20 dB ($L_{Aeq,10mins}$) in total in the frequency bands 31.5 to 125 Hz. A very simple way of achieving this, and of eliminating the need for any further involvement by the territorial authority, would be to make a ruling that no wind farm shall be situated less than say 5 to 10 kilometres away from any residence unless the occupant agrees in writing for this condition to be waived"*. The paper is attached as annexure 30.

135. There are valid concerns expressed by acousticians and clinicians, on the basis of clinical and resident adverse health event reports, population noise impact surveys and acoustic measurements, that even with the current limited knowledge, the buffer distances from larger industrial wind turbines need to be much greater than 2 km, in order to protect the health and amenity of residents who are hosts as well as neighbours, and their family members who may be in the particularly at risk groups such as babies, young children, noise sensitive individuals such as those with brain injuries, autism spectrum disorders, and the elderly.

136. The recent neurophysiological research work conducted by Professor Salt and Professor Lichtenhan, and detailed in their letter to the Victorian Health department strongly criticising that department's recent report which asserted that there is no evidence that infrasound could be causing the reported health problems in the residents. The letter from the two scientists lists their work in

this area of the effects of infrasound on the inner ear (in which they are world leaders) and also lists a number of proven pathophysiological mechanisms they have clearly demonstrated experimentally in mammalian studies, which they suspect are playing an important direct causative role in the pathology and symptoms being reported by residents living near wind turbines. Their letter is annexure 31.

137. Emeritus Professor Colin Hansen, a highly regarded academic mechanical engineer with a longstanding career investigating low frequency noise, from the University of Adelaide, who is currently leading the field work in wind turbine acoustical survey work at Waterloo wind development, also wrote to the Victorian Department of Health to strongly criticise their report for similar reasons. Professor Hansen made it clear that on the basis of his recent field work at Waterloo, under certain wind and weather conditions a significant number of local residents could be affected by the wind turbine acoustic emissions in the very low frequencies out to 5 – 10km and that this could be expected to disturb their sleep. Professor Hansen's letter is annexure 32.

138. Recent laboratory research by a Psychology graduate and PhD candidate in New Zealand, by the name of Fiona Crichton, was widely publicised by the wind industry internationally, and purported to provide supportive evidence that the symptoms being reported by wind turbine neighbours were due to "scaremongering" or the "nocebo effect". Ms Crichton has made public statements in written and media interviews asserting that those who publicise the existence of the known and well documented adverse health effects from low frequency noise are themselves causing the symptoms. Her study has been strongly criticised by acousticians and audiologists with direct field and research

knowledge of the problems, as the exposures used in her experiment (10 minutes at a low "dose" during the daytime) bear no relationship to the exposures to wind turbine noise at higher "doses", a wide range of frequencies, and durations of 24/7 for 25 years including at night, resulting in sleep disturbance. In addition her subjects were young students, whereas wind turbine neighbours and hosts are a range of ages including those known to be more vulnerable to the deleterious effects of the acoustic pollution include those at the extremes of age ie the elderly and the very young. Critiques of that research, together with critiques of Professor Simon Chapman's "nocebo" research previously mentioned, which relies heavily on this Crichton laboratory research, are at annexure 33.

139. Dr Michael Nissenbaum's comments to the Australian Federal Senate inquiry on the issue of invoking the "nocebo diagnosis" are particularly pertinent, given that neither Professor Chapman nor Ms Crichton have medical qualifications, and are therefore not trained to diagnose medical conditions. Nissenbaum stated the following: *"On 'nocebo', if a physician provides the diagnosis of 'nocebo' (a psychologically mediated effect analogous to a 'psychosomatic illness/response'), medical protocols dictate that it be done subsequent to a process of thoroughly excluding the possibility of any pathophysiological pathways that are plausible, more likely, or more important (because of serious downstream implications) to consider."* Nissenbaum went on to point out that "*The 'nocebo' concept is inapplicable and it would be irresponsible to apply it as an explanation for the chronic sleep disorders which are the result of often unremembered nighttime arousals related to noise (a simple physiological chain of events that is not medically controversial in the least, and which are detectable by validated investigational tools such as used in our study). It's rushed*

utilization here would be a conjectural, unfair and cruel exercise that would in effect tell people that while what they are feeling may be real, the origin is 'all in their head' rather than in well understood physiological interactions between the sleep mechanism and noise". Nissenbaum's final point is a very important one "*Finally, suggesting a diagnosis of 'nocebo' without investigating, 'boots on the ground', for more plausible, better understood, or more logical causes of a medical condition would normally constitute medical malpractice in most Western-based medical systems, including Australia. Individuals who are not physicians are not limited by this professional mandate or even necessarily this conceptual framework. Please bear that in mind when deliberating the opinions (which, when not backed up by the evidence would by definition be superficial – and possibly contrived) – of witnesses or experts who opine on medical matters."*

140. A recent Canadian literature review from Dr Michael Arra and Dr Hazel Lynn is a refreshing counter to the numerous government reviews which continue to assert that "there is no evidence" of a problem with wind turbine noise. Dr Arra and Dr Lynn are both public health physicians, with the professional and ethical obligations that are part of being a medical practitioner. Their literature review sought to determine whether or not there was an effect, from operating wind turbines and wind turbine noise. They found that in every single peer reviewed study with empirical data collected directly from wind turbine neighbouring residents, that there was evidence of what they termed "human distress". The literature review itself is undergoing peer review prior to publication in a peer reviewed journal but the powerpoint with relevant details is included as annexure 35.

141. A recent case in Australia (The Cherry Tree case) has resulted in judicial acceptance of the fact that some residents living near wind turbines develop a range of characteristic symptoms which the Commissioners presiding over that case have accepted are real, and not "imagined".

142. David Mortimer is a wind turbine host who receives money for hosting wind turbines on his property and has developed the characteristic symptoms which occur with exposure to wind turbine noise. His wife too has developed symptoms. David gave evidence in the Cherry Tree case, thereby debunking the myth used by the wind industry and its supporters to assert that there are no adverse health problems because "no wind turbine hosts report symptoms". This statement is untrue. David also referred to acoustic data collected by Mr Les Huson, an acoustic engineer engaged by the Waubra Foundation to collect acoustic data in December 2012, which clearly showed wind turbine acoustic emissions including infrasound and low frequency noise inside his home at the time he was symptomatic. David's statement is annexure 36.

143. The Commissioners in the Cherry Tree case handed down their orders on the 4th April 2013, and are at annexure 37. On the basis of the evidence presented to them, including David Mortimer's written and oral evidence including cross examination, and my own written and oral evidence and cross examination, the Commissioners have deferred their decision, acknowledged the "knowledge vacuum" which exists, and asked for further information to be presented to the Tribunal in September, 2013, from the updated literature review being conducted by the National Health and Medical Research Council, and the Acoustic survey being conducted by the South Australian Environment Protection Authority at Waterloo wind development in South Australia.

144. The pertinent extracts from the Commissioners orders in the Cherry Tree case are quoted below:

para 116

"***There is evidence before the Tribunal that a number of people living close to wind farms suffer deleterious health effects. The evidence is both direct and anecdotal. There is a uniformity of description of these effects across a number of wind farms, both in southeast Australia and North America. Residents complain of suffering sleep disturbance, feelings of anxiety upon awakening, headaches, pressure at the base of the neck and in the head and ears, nausea and loss of balance."***

para 117

"In some cases the impacts have been of such gravity that residents have been forced to abandon their homes."

para 118

"On the basis of this evidence it is clear that some residents who live in close proximity to a wind farm experience the symptoms described, and that the experience is not simply imagined".

145. This proposal for Bull Creek wind project should therefore be rejected on the basis of its potential to cause serious adverse health effects from sleep disturbance alone, to a significant number of people, including the wind turbine hosts and their dependents as well as the members of KLG and their families.

146. **The proposed industrial wind turbine development should be rejected until the developer can prove with independently conducted peer reviewed scientific, acoustic and medical research that its industrial wind development will not cause harm to the health of rural people living and working nearby**, through chronic cumulative exposure to unsafe levels of low frequency noise and infrasound emitted from the industrial wind turbines proposed, over the life of the project.

Sarah Elisabeth Laurie, BMBS, Flinders University, 1995

CEO Waubra Foundation,

signed and submitted 27th June, 2013

List of links to annexures listed in this statement

1. Waubra Foundation Objectives (view at www.waubrafoundation.com.au)
2. Submission by the Parkville Residents association to the Federal Senate inquiry, submission number 389, submitted by Mr Gerry Noonan (http://www.aph.gov.au/Parliamentary_Business/Committees/Senate_Committees?url=clac_ctte/completed_inquiries/2010-13/impact_rural_wind_farms/index.htm
3. Dr Amanda Harry "Wind Turbines, Noise and Health" https://www.wind-watch.org/documents/wind-turbines-noise-and-health/
4. Dr David Iser's survey results and letters to government officials https://www.wind-watch.org/documents/toora-wind-farm-health-effects-survey-2004/
5. National Institute of environmental health sciences Literature Review 2001 https://www.wind-watch.org/documents/infrasound-brief-review-of-toxicological-literature/
6. Leventhall et al, 2003 report for UK Department of Environment, Food and Rural Affairs (DEFRA) https://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/
7. Briefing summary, Zhenhua Wang, first attachment at the following link: https://www.wind-watch.org/news/2012/07/18/open-letter-to-the-premier-of-south-australia-re-new-survey-at-waterloo-wind-farm/
8. Morris, M Waterloo Survey, attachments two and three at the following link: https://www.wind-watch.org/news/2012/07/18/open-letter-to-the-premier-of-south-australia-re-new-survey-at-waterloo-wind-farm/
9. Schneider, P Cullerin Range Survey, https://www.wind-watch.org/documents/cullerin-range-wind-farm-survey-august-2012/
10. Professor Moller & Professor Pedersen, 2011 Journal of the Acoustic Society of America "Low frequency noise from large wind turbines" https://www.wind-watch.org/documents/low-frequency-noise-from-large-wind-turbines-2/
11. Professor Carl Phillips, "Properly interpreting the epidemiological evidence about the health effects of industrial wind turbines on nearby residents" 2011 https://www.wind-watch.org/documents/properly-interpreting-the-epidemiologic-evidence-about-the-health-effects-of-industrial-wind-turbines-on-nearby-residents/

12. Capuccio et al February 2011 " sleep duration predicts cardiovascular outcomes: a systematic review and meta analysis of prospective studies" http://eurheartj.oxfordjournals.org/content/early/2011/02/03/eurheartj.ehr007.full
13. McEwen, Bruce, "Protective and Damaging Effects of Stress Mediators" NEJM 1998, 338:171-179 (attached at **Tab 1**)
14. McMurtry, R "Toward a Case Definition of Adverse Health Effects in the Environs of Industrial Wind Turbines: Facilitating a Clinical Diagnosis" accessible via https://www.wind-watch.org/documents/wind-turbine-noise-and-health-special-issue-of-bulletin-of-science-technology-society/
15. Nobbs, B Doolan C, and Moreau D "Characterisation of noise in homes affected by wind turbine noise" 2012 https://www.wind-watch.org/documents/characterisation-of-noise-in-homes-affected-by-wind-turbine-noise/
16. Salt, A et al "Perception based protection from low frequency sounds may not be enough" 2012 https://www.wind-watch.org/documents/perception-based-protection-from-low-frequency-sounds-may-not-be-enough/
17. Swinbanks, M "Numerical simulation of infrasound perception, with reference to reported laboratory effects" 2012 https://www.wind-watch.org/documents/numerical-simulation-of-infrasound-perception/
18. Qibai et al, "An investigation on the Physiological and Psychological effects of infrasound on persons" 2004 https://www.wind-watch.org/documents/an-investigation-on-the-physiological-and-psychological-effects-of-infrasound-on-persons/
19. Cooper, Steven "Are wind farms too close to communities?" 2012 https://www.wind-watch.org/documents/are-wind-farms-too-close-to-communities/
20. Ambrose, S & Rand, R "Bruce McPherson Infrasound and Low frequency noise study" December, 2011 https://www.wind-watch.org/documents/bruce-mcpherson-infrasound-and-low-frequency-noise-study/
21. Walker, B, Hessler G, Hessler, D, Rand R and Schomer, P December 2012 joint report "Cooperative Measurement survey and analysis of low frequency and infrasound at the Shirley wind Farm" https://www.wind-watch.org/documents/cooperative-measurement-survey-and-analysis-of-low-frequency-and-infrasound-at-the-shirley-wind-farm/
22. Schomer, P appendix D access via above weblink
23. Rand, R appendix C access via above weblink
24. Shepherd, D et al "Evaluating the impact of wind turbine noise on health related quality of life" October 2011 https://www.wind-watch.org/documents/evaluating-the-impact-of-wind-turbine-noise-on-health-related-quality-of-life/
25. Nissenbaum, M, Hanning, C and Aramini, J "Effects of industrial wind turbine noise on sleep and health" October 2012 https://www.wind-watch.org/documents/effects-of-industrial-wind-turbine-noise-on-sleep-and-health/
26. Thorne, R "Wind Farm Generated Noise and Adverse health Effects" November 2012, https://www.wind-watch.org/documents/wind-farm-generated-noise-and-adverse-health-effects/

27. Black, Owen MD, neurotologist Affidavit 2009 download as first attachment of the document at the following weblink: https://www.wind-watch.org/documents/list-of-symptoms-and-medical-problems/
28. Waubra Foundation's Explicit Cautionary Notice, June 2011, https://www.wind-watch.org/documents/explicit-cautionary-notice-to-those-responsible-for-wind-turbine-siting-decisions/
29. Waubra Foundation's Acoustic Pollution Assessment Requirements, May 2012 https://www.wind-watch.org/documents/wind-turbine-acoustic-pollution-assessment-requirements/
30. Dickinson, Professor P "Pragmatic view of a wind turbine noise standard" https://www.wind-watch.org/documents/pragmatic-view-of-a-wind-turbine-noise-standard/
31. Salt, Professor Alec and Lichtenhan, Professor Jeffrey Letter to Victorian Health department https://www.wind-watch.org/documents/letter-to-victoria-dept-of-health-re-physiologic-effects-of-inaudible-sound/
32. Hansen, Professor Colin Letter to Victorian Health department https://www.wind-watch.org/documents/letter-to-victoria-dept-of-health-re-acoustics-of-wind-turbine-noise/
33. Multiple critiques of the Crichton and Chapman "nocebo" research include the following:
    Punch, Professor Jerry https://www.wind-watch.org/documents/review-of-crichton-et-al-can-expectations-produce-symptoms-from-infrasound-associated-with-wind-turbines/
    Swinbanks, Dr Malcolm https://www.wind-watch.org/documents/can-expectations-produce-symptoms-from-infrasound-associated-with-wind-turbines/
    McMurtry, Professor Robert https://www.wind-watch.org/documents/mcmurtry-commentary-on-chapman-nocebo-paper/
34. Nissenbaum, Dr Michael, response to a question on notice to the Australian Federal Senate inquiry November 2012 https://www.wind-watch.org/documents/reply-of-dr-michael-a-nissenbaum-to-senate-inquiry/
35. Arra, Dr Michael and Lynn, Dr Hazel Literature Review for the Grey Bruce Health Unit in Ontario 2013 "The association between wind turbine noise and human distress" https://www.wind-watch.org/documents/association-between-wind-turbine-noise-and-human-distress-literature-review/
36. Statement of David Mortimer, wind turbine host, to the Cherry Tree VCAT hearing in February, 2013 (attached at **Tab 2**)
37. Commissioners Wright and Liston's orders in the Cherry Tree case, VCAT, Victoria, Australia 4th April, 2013 https://www.wind-watch.org/documents/six-month-adjournment-order-to-study-health-effects/

Additional material referenced and tabled during oral evidence given by the Waubra Foundation CEO Sarah Laurie during the Cherry Tree VCAT Hearing in Melbourne, Australia on 7th & 8th February, 2013

- Documents obtained under FOI from Victorian Department of Health, confirming complaints were received from Victorian residents in 2009. This is prior to the establishment of the Waubra Foundation in 2010, and is evidence that the problems were in existence before any publicity generated by the foundation (ie the nocebo "diagnosis" is erroneous).
- Dr Sandy Reider MD testimony to the Vermont Legislature http://www.windturbinesyndrome.com/2013/acoustic-trauma-produced-by-large-wind-turbines-is-real-and-significant-sandy-reider-md-vermont/?var=cna
- Submission from Dr Wayne Spring, Ballarat Sleep Physician to second Australian federal senate inquiry http://www.windturbinesyndrome.com/2012/sleep-specialist-physician-treats-patients-with-wind-turbine-syndrome-australia/?var=cna
- Submission from Dr Andja Mitric Andjic, Rural GP and wind turbine refugee (formerly a neighbour of Hepburn Wind's "community" wind turbines) to second Australian Federal senate inquiry http://www.windturbinesyndrome.com/2012/there-is-something-horribly-wrong-with-wind-turbine-technology-says-physician-driven-out-of-her-home-australia/?var=cna
- Submission from Mr Peter Trask, Psychologist to second Australian Federal senate inquiry http://www.windturbinesyndrome.com/2012/wind-turbine-syndrome-is-real-reports-clinical-psychologist-australia/?var=cna
- Response to a question on notice by Dr Michael Nissenbaum, to the second Federal Senate inquiry, concerning the use of "nocebo". The document can be downloaded from http://docs.wind-watch.org/Nissenbaum-Nocebo-senate-inquiry-11-22-2012.pdf
- Article written for the Copenhagen Post, by former High court judge Peter Roerdam, . https://www.wind-watch.org/news/2012/11/16/the-myth-of-denmark-as-a-corruption-free-country/
- Wisconsin town Council association's call for a moratorium https://www.wind-watch.org/documents/resolution-adopted-by-the-board-of-directors-of-wisconsin-towns-association/
- Brown County Health Board http://www.windturbinesyndrome.com/2012/board-of-health-asks-state-for-emergency-financial-relocation-assistance-for-wind-turbine-syndrome-victims-wisconsin/
- Farboud et al "Wind turbine Syndrome: Fact or Fiction?" Review article in Journal of Otology and Laryngology, 2013 https://www.wind-watch.org/documents/wind-turbine-syndrome-fact-or-fiction-2/
- Dr Owen Black's CV from http://www.legacyhealth.org/en/for-health-professionals/legacy-research-institute/our-scientists/f-owen-black-md-facs.aspx
- Dr Nina Pierpont's study "Wind Turbine Syndrome, A report on a Natural Experiment" 2009 K Selected Books

- Notes made for the VCAT Commissioners concerning the application of the Bradford Hill Criteria of Causation to the symptoms being reported by people exposed to operating wind turbines (see following pages).

NOTES FOR COMMISSIONERS
RE APPLICATION OF BRADFORD HILL CRITERIA OF CAUSATION

Comments on the 9 criteria are made below, with reference to comments by the authors in the following article, quoted in italics where relevant:

http://neuro.psychiatryonline.org/article.aspx?articleid=101454
Special Article | August 01, 2001
Applying Bradford Hill's Criteria for Causation to Neuropsychiatry: Challenges and Opportunities
Robert van Reekum, M.D., F.R.C.P.C.; David L. Streiner, Ph.D., C.Psych.; David K. Conn, M.B., F.R.C.P.C.
The Journal of Neuropsychiatry and Clinical Neurosciences 2001;13:318-325.
10.1176/appi.neuropsych.13.3.318

1. Strength of the Association

"*Clearly if condition A causes outcome B, then it must be that A and B can be demonstrably associated with each other. The association has to be strong enough to be judged clinically significant by the reader of the argument. This is a necessary, but not sufficient, criterion in establishing an argument of causation. "*

Studies with adequate control populations will help investigate this. (Dr Daniel Shepherd & Dr Michael Nissenbaum's studies have started this process at a population level).

The most compelling information comes from individual exposure information in those who are affected.
"case cross over" designs – where people are exposed and have symptoms, then they reduce their exposure and the symptoms go away, but return when they are reexposed. Dr Sandy Reider gives a very good description of this in his statement to the Vermont legislature.

Dr Nina Pierpont's case series cross over study is the most rigorously collected data of this type, and is very detailed. Her contribution to the knowledge of vestibular disorders and the relationship with clinical symptoms being reported is respected amongst those ENT specialists who are (or were) leaders in the world in this very poorly understood area of clinical medicine (eg Dr Owen Black). Increasingly acousticians are also starting to publicly recognise her contribution. Professor Leventhall has admitted under oath in Canada that he acknowledged she had identified groups in the population who seem more susceptible to developing problems (eg inner ear disorders, migraines, and motion sickness, as well as the extremes of age)

2. Consistency of the Evidence

The effects on SLEEP are consistent. People are describing waking up repetitively in an anxious frightened panicked state. They often say they do not hear the turbines at the time (see Dr Reider's statement for an excellent clinical description). Some just describe waking up tired, for no reason. Children who previously slept well have poor sleep, with (for example) babies waking up repetitively screaming where they never did this before, and never do it when away from their homes, or when the turbines are not turning. This then disturbs their parent's sleep. The accumulated effects of this over time lead to a myriad of health problems.

The inability to stop the noise and vibration and the lack of control over that in itself leads to significant psychological stress, anger, and often depression in people, as well as anxiety about whether or not they are going to get a good night's sleep. People become focused on the weather forecast, and

plan their lives around which way the wind is coming from, making plans to be away from home if the wind is coming from a certain direction because they know they will get symptoms on those days. This inevitably affects many other aspects of their lives – their work, family entertaining, ability to have guests to stay etc etc.

Once people are sensitised to ILFN, they then notice other sources of ILFN may give them the symptoms (especially tinnitus). Other sources have included large air conditioners (eg court buildings in Adelaide, aeroplanes, and smaller compressors from home air conditioners)
The range of symptoms are consistent within an individual, but there is variable expression of them in different people, which is entirely to be expected if they result from chronic stress. Chronic stress will affect a multitude of different body systems in a variety of different ways, known to clinical medicine since 1998 (Bruce McEwen's paper).

3. Specificity

This criterion stems from old beliefs related to a one-disease, one-outcome model of illness. Clearly this criterion does not hold even for infectious diseases or toxin exposures, in which multiple pathogens may produce the same set of symptoms, or in which a single pathogen may produce a number of outcomes. E. coli may produce urinary tract infections as well as infections of the gastrointestinal system, and both of these types of infections may also be produced by a number of other pathogens. Similar concerns limit the validity of this criterion in neuropsychiatry; that is, if specificity can be demonstrated, then this is additional support for causation, ***but if specificity is lacking, then this in no way detracts from the argument of causation.***

4. Temporal Sequence

Clearly if A is causing B, then A should necessarily occur prior to B.

As with all health-related research, the only way to be certain about the temporal sequence is to conduct prospective studies, in which the samples are studied (for presence of the outcome) prior to the onset of the putative causative agent and then followed over time after the insult*.*

5. Biological Gradient

Is there a dose response effect? The clinical symptoms being reported suggest there is. It needs to be properly investigated, which Professor Con Doolan has started to do with some case studies from Waterloo.

Con Doolan's research suggests there is a dose response effect in the reported case, and in the other data he has collected. I know the residents who are subjects in those studies and their symptoms and pattern of symptoms are characteristic of people exposed to operating wind turbines who have an effect.

6. Biologic Rationale

Is it biologically plausible?

Salt's work, and the work discussed in the NIEHS infrasound toxicology suggest the underlying mechanisms of the effects being observed in humans.

- Alerting mechanism – especially in quiet background noise environments
- Qibai and Shi – infrasound stimulation leads to sympathetic nervous system stimulation with elevated heart rate and blood pressure in many of the subjects. Individual variation is consistent with what we are seeing in the field. They also reported nausea, tiredness and "fretfulness".

- In Qibai and Shi, the infrasound dose is BELOW the audible perception threshold (see Swinbanks work)
- NIEHS toxicology studies show three effects:

1. Physiological stress – release of adrenaline and cortisol with exposure to infrasound
2. Sequential tissue damage eg to myocardium (heart muscle) with sequential sacrifices with ongoing exposure – tissue damage gets worse with ongoing exposure but resolves with cessation
3. Oxidative stress is a biological mechanism – confirmed with study number 58 Dadali

What dose is required to do this?
Over what period of time? There is clinical evidence of a cumulative exposure effect – worse over time. Dr Bob Thorne's data from Victorian wind developments captured the "snapshot" after 2 years exposure and the results confirm my clinical impressions and that of their doctors – these people are sick.

7. Coherence

Is this consistent with what we already know?
As with the biologic rationale criterion, if this criterion is met, then it is supportive of an argument of causation; if not, then we may simply not yet know enough, or we may need to revisit that which we think we know.

8. Experimental Evidence

Experimental evidence is the most compelling evidence of causation. *If it can be shown that experimentally (ideally randomly) inducing the causative agent consistently produces the outcome, at greater rates than in a nonexposed control sample, this is clear and compelling evidence of causation.* ***However, it is obvious that such evidence will be rare in neuropsychiatry, as it is grossly unethical to induce most forms of brain dysfunction experimentally in humans. Experimental approaches are often applied to nonhuman species, but this practice is also increasingly considered to raise ethical concerns***.

WHAT ABOUT THE ETHICS OF USING THIS TECHNOLOGY, NOT INVESTIGATING WHAT IS GOING ON DESPITE THE MANY SERIOUS COMPLAINTS, BY RESIDENTS AND BY SOME OF THEIR TREATING DOCTORS?

9. Analogous Evidence

This approach takes the form of thinking that if some condition similar to A causes an outcome similar to B, then this is evidence that A causes B.

We know what sleep deprivation does to people

We know what chronic stress does to people.

Both stress and serious cumulative sleep disturbance are being reported by people living near wind turbines, as are the resultant conditions.

This is further supportive evidence that the wind turbines are causing these symptoms.

The precise noise and vibration frequencies which are causing these symptoms in people, especially the episodes of night time waking in a panicked state, and the body vibrations are yet to be precisely determined. We do not know what doses acutely will induce this effect, nor do we know what doses will do this once people are sensitised. The concern is that we do not know what the SAFE Exposure cumulative dose is for adults AND particularly young children.

However given that these are being reported by residents out to 10km from Waterloo for example, our suspicion is that it will be the frequencies below 200 Hz which are responsible. These are well known to travel longer distances than the audible noise which attenuates far more rapidly. Salt's experimental work suggests that the effect of this sound energy in locations where there is very little ambient noise, is much greater physiologically than has been previously understood.

Large turbines emit more LFN proportionately (Moller & Pedersen's paper) so you would expect a greater effect out to greater distances as the turbines increase in height. That is what we are already seeing out at Macarthur, (VESTAS V112's) where symptoms such as sleep disturbance are being reported already out to 6 – 7 km, and that development has not even been officially commissioned.

Review Article

Seminars in Medicine of the Beth Israel Deaconess Medical Center

JEFFREY S. FLIER, M.D., *Editor*
LISA H. UNDERHILL, *Assistant Editor*

PROTECTIVE AND DAMAGING EFFECTS OF STRESS MEDIATORS

BRUCE S. MCEWEN, PH.D.

OVER 60 years ago, Selye[1] recognized the paradox that the physiologic systems activated by stress can not only protect and restore but also damage the body. What links these seemingly contradictory roles? How does stress influence the pathogenesis of disease, and what accounts for the variation in vulnerability to stress-related diseases among people with similar life experiences? How can stress-induced damage be quantified? These and many other questions still challenge investigators.

This article reviews the long-term effect of the physiologic response to stress, which I refer to as allostatic load.[2] Allostasis — the ability to achieve stability through change[3] — is critical to survival. Through allostasis, the autonomic nervous system, the hypothalamic–pituitary–adrenal (HPA) axis, and the cardiovascular, metabolic, and immune systems protect the body by responding to internal and external stress. The price of this accommodation to stress can be allostatic load,[2] which is the wear and tear that results from chronic overactivity or underactivity of allostatic systems.

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THE PHYSIOLOGIC RESPONSE TO STRESS

Stressful experiences include major life events, trauma, and abuse and are sometimes related to the environment in the home, workplace, or neighborhood. Acute stress (in the sense of "fight or flight" or major life events) and chronic stress (the cumulative load of minor, day-to-day stresses) can both have long-term consequences. The effects of chronic stress may be exacerbated by a rich diet and the use of tobacco and alcohol and reduced by moderate exercise.

Genetic factors do not account for all the individual variability in sensitivity to stress, as evinced by the lack of concordance between identical twins in many disorders.[4,5] Moreover, genetic factors do not explain the gradients of health across socioeconomic levels in Western societies.[6] Two factors largely determine individual responses to potentially stressful situations: the way a person perceives a situation[7] and a person's general state of physical health, which is determined not only by genetic factors but also by behavioral and lifestyle choices (Fig. 1). Whether one perceives a situation as a threat, either psychological or physical, is crucial in determining the behavioral response — whether it is fleeing, fighting, or cowering in fear — and the physiologic response — calmness or heart palpitations and elevated cortisol levels.

The ability to adjust or habituate to repeated stress is also determined by the way one perceives a situation. For example, most people react initially to the challenge of public speaking with activation of the HPA axis. After repeated public speaking, however, most people become habituated and their cortisol secretion no longer increases with the challenge. But approximately 10 percent of subjects continue to find public speaking stressful, and their cortisol secretion increases each time they speak in public.[8] Others are prone to a cardiovascular stress response, as shown by a recent study of cardiovascular responses to a stressful arithmetic test. Blood-pressure responses to this experimental stress predicted elevated ambulatory blood pressure during periods of perceived stress in everyday life.[9] Genetics may also have a role in susceptibility to cardiovascular stress; many people whose blood pressure remains elevated for several hours after the stress of an arithmetic test have a parent with hypertension.[10]

One's physical condition has obvious implications for one's ability to mount an appropriate physiologic response to stressful stimuli, and there may be a genetic component to the response as well. In inbred

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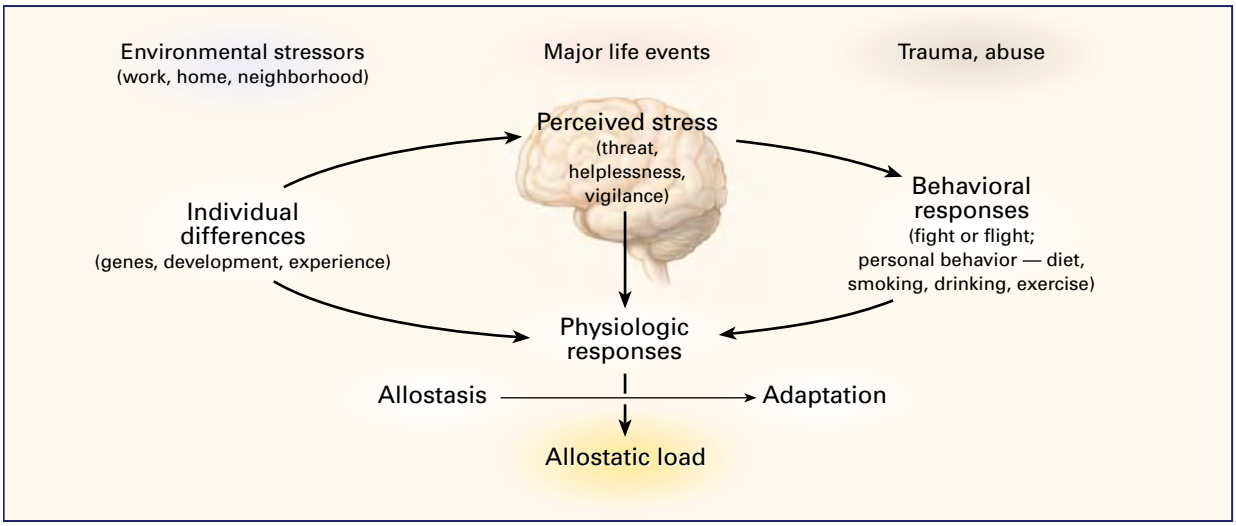

Figure 1. The Stress Response and Development of Allostatic Load.

The perception of stress is influenced by one's experiences, genetics, and behavior. When the brain perceives an experience as stressful, physiologic and behavioral responses are initiated, leading to allostasis and adaptation. Over time, allostatic load can accumulate, and the overexposure to mediators of neural, endocrine, and immune stress can have adverse effects on various organ systems, leading to disease.

BioBreeding (BB) rats, an animal model of insulin-dependent diabetes, exposure to repeated stress increased the incidence of diabetes.[11] In children, family instability increases the incidence and severity of insulin-dependent diabetes.[12] Chronic stress, defined as feelings of fatigue, lack of energy, irritability, demoralization, and hostility, has been linked to the development of insulin resistance,[13] a risk factor for non-insulin-dependent diabetes. Deposition of abdominal fat, a risk factor for coronary heart disease and diabetes,[14] is increased by the psychosocial stress of colony reorganization in nonhuman primates[15] and may also be increased by stress in humans.[16]

ALLOSTASIS AND ALLOSTATIC LOAD

In contrast to homeostatic systems such as blood oxygen, blood pH, and body temperature, which must be maintained within narrow ranges, allostatic (adaptive) systems have much broader boundaries. Allostatic systems enable us to respond to our physical states (e.g., awake, asleep, supine, standing, exercising) and to cope with noise, crowding, isolation, hunger, extremes of temperature, danger, and microbial or parasitic infection.

The core of the body's response to a challenge — whether it is a dangerous situation, an infection, living in a crowded and unpleasant neighborhood, or a public-speaking test — is twofold, turning on an allostatic response that initiates a complex adaptive pathway, and then shutting off this response when the threat is past. The most common allostatic responses involve the sympathetic nervous systems and the HPA axis. For these systems, activation releases catecholamines from nerves and the adrenal medulla and leads to the secretion of corticotropin from the pituitary. The corticotropin, in turn, mediates the release of cortisol from the adrenal cortex. Figure 2 shows how catecholamines and glucocorticoids affect cellular events. Inactivation returns the systems to base-line levels of cortisol and catecholamine secretion, which normally happens when the danger is past, the infection is contained, the living environment is improved, or the speech has been given. However, if the inactivation is inefficient (see below), there is overexposure to stress hormones. Over weeks, months, or years, exposure to increased secretion of stress hormones can result in allostatic load[2] and its pathophysiologic consequences.

Four situations are associated with allostatic load (Fig. 3). The first and most obvious is frequent stress. For example, surges in blood pressure can trigger myocardial infarction in susceptible persons,[17] and in primates repeated elevations of blood pressure over periods of weeks and months accelerate atherosclerosis,[18] thereby increasing the risk of myocardial infarction.

In the second type of allostatic load (Fig. 3), adaptation to repeated stressors of the same type is lacking, resulting in prolonged exposure to stress hormones, as was the case for some of the people subjected to the repeated-public-speaking challenge.[8]

In the third type of allostatic load (Fig. 3) there is an inability to shut off allostatic responses after a stress is terminated. As we have noted, the blood

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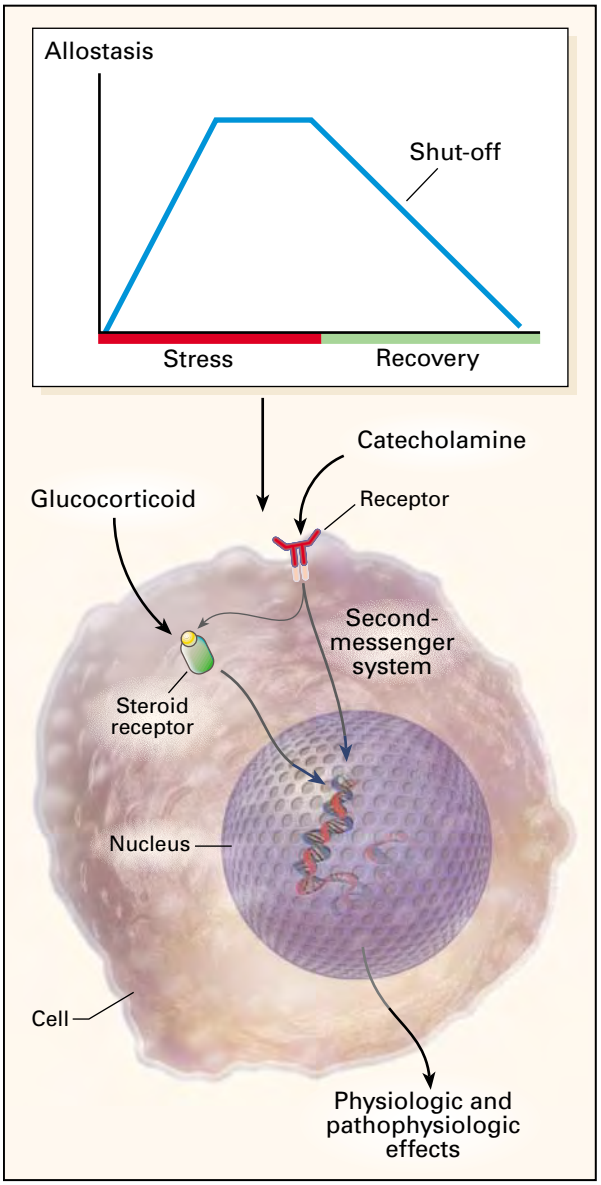

Figure 2. Allostasis in the Autonomic Nervous System and the HPA Axis.

Allostatic systems respond to stress (upper panel) by initiating the adaptive response, sustaining it until the stress ceases, and then shutting it off (recovery). Allostatic responses are initiated (lower panel) by an increase in circulating catecholamines from the autonomic nervous system and glucocorticoids from the adrenal cortex. This sets into motion adaptive processes that alter the structure and function of a variety of cells and tissues. These processes are initiated through intracellular receptors for steroid hormones, plasma-membrane receptors, and second-messenger systems for catecholamines. Cross-talk between catecholamines and glucocorticoid-receptor signaling systems can occur.

pressure in some people fails to recover after the acute stress of an arithmetic test,[10] and hypertension accelerates atherosclerosis.[18] Women with a history of depressive illness have decreased bone mineral density, because the allostatic load of chronic, moderately elevated serum cortisol concentrations inhibits bone formation.[19] Intense athletic training also induces allostatic load in the form of elevated sympathetic and HPA-axis activity, which results in weight loss, amenorrhea, and the often-related condition of anorexia nervosa.[20,21]

The failure to turn off the HPA axis and sympathetic activity efficiently after stress is a feature of age-related functional decline in laboratory animals,[22-24] but the evidence of this in humans is limited.[25,26] Stress-induced secretion of cortisol and catecholamines returns to base line more slowly in some aging animals with other signs of accelerated aging,[22-24] and the negative-feedback effects of cortisol are reduced in elderly humans.[26] One other sign of age-related impairment in rats is that the hippocampus fails to turn off the release of excitatory amino acids after stress,[27] and this may accelerate progressive structural damage and functional impairment (see below).

One speculation is that allostatic load over a lifetime may cause the allostatic systems to wear out or become exhausted.[25] A vulnerable link in the regulation of the HPA axis and cognition is the hippocampal region. According to the "glucocorticoid-cascade hypothesis," wear and tear on this region of the brain leads to dysregulation of the HPA axis and cognitive impairment.[23,28] Indeed, some but not all aging rats have impairment of episodic, declarative, and spatial memory and hyperactivity of the HPA axis, all of which can be traced to hippocampal damage.[29] Recent data suggest that similar events may occur in humans.[30,31]

In the fourth type of allostatic load (Fig. 3), inadequate responses by some allostatic systems trigger compensatory increases in others. When one system does not respond adequately to a stressful stimulus, the activity of other systems increases, because the underactive system is not providing the usual counterregulation. For example, if cortisol secretion does not increase in response to stress, secretion of inflammatory cytokines (which are counterregulated by cortisol) increases.[32] The negative consequences of an enhanced inflammatory response are seen, for example, in Lewis rats; these animals are very susceptible to autoimmune and inflammatory disturbances, because of a genetically determined hyporesponsiveness of the HPA axis.[33]

In another model, rats that become subordinate in a psychosocial living situation called the "visible-burrow system" have a stress-induced state of HPA hyporesponsiveness.[34,35] In these rats, the response to stressors applied by the experimenter is very limited, and concentrations of corticotropin-releasing

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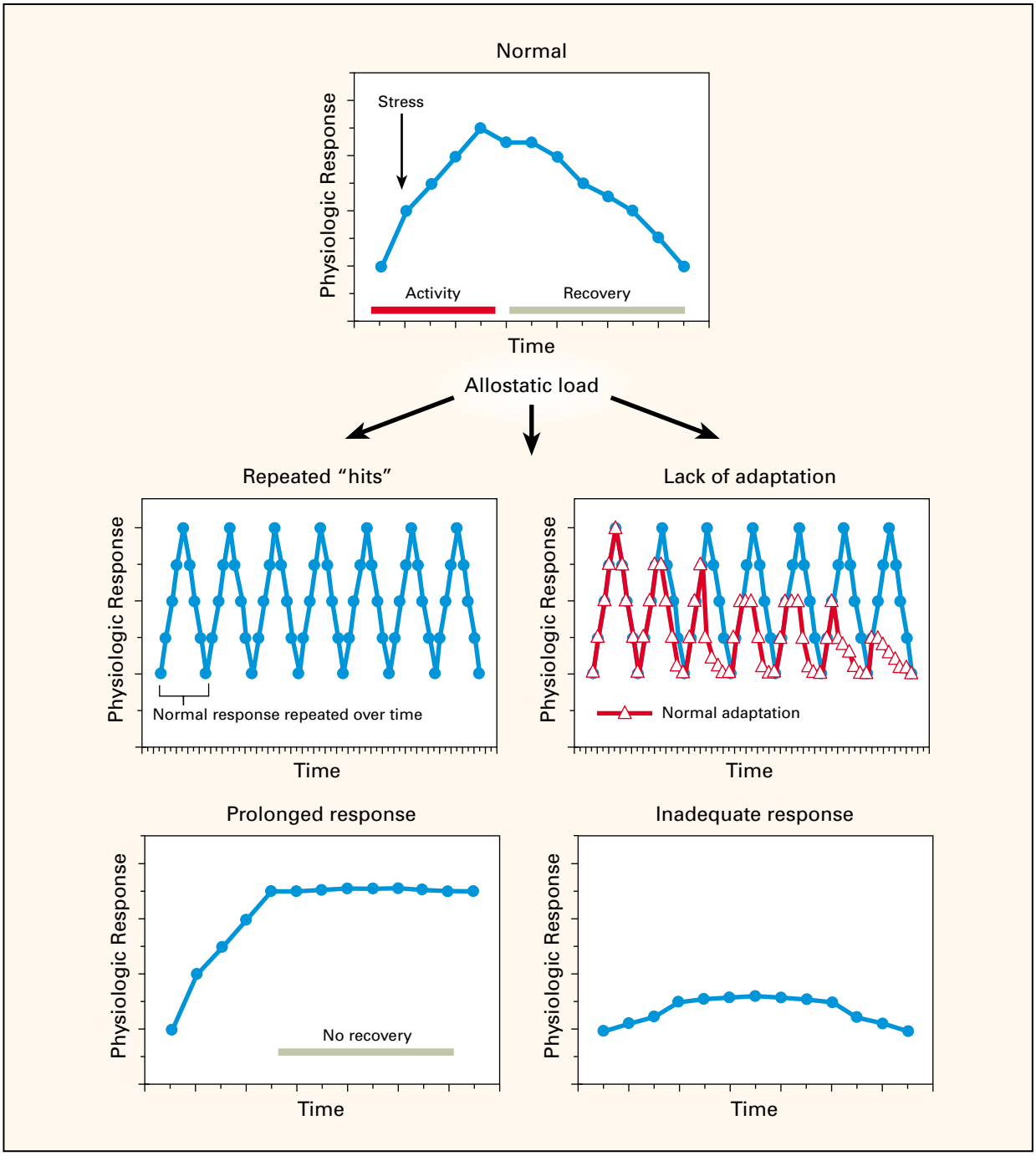

Figure 3. Three Types of Allostatic Load.

The top panel illustrates the normal allostatic response, in which a response is initiated by a stressor, sustained for an appropriate interval, and then turned off. The remaining panels illustrate four conditions that lead to allostatic load: repeated "hits" from multiple stressors; lack of adaptation; prolonged response due to delayed shutdown; and inadequate response that leads to compensatory hyperactivity of other mediators (e.g., inadequate secretion of glucocorticoids, resulting in increased concentrations of cytokines that are normally counterregulated by glucocorticoids).

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hormone messenger RNA in the hypothalamus are abnormally low.[36] Human counterparts with HPA hyporesponsiveness include adults with fibromyalgia[37,38] and chronic fatigue syndrome[39,40] and children with atopic dermatitis.[41] In post-traumatic stress disorder, basal HPA activity is also low,[42,43] although reactivity to stress may not be blunted.

Feelings of anticipation and worry can also contribute to allostatic load.[44] Anticipation participates in the reflex that prevents us from blacking out when we get out of bed in the morning[3] and is also part of worry, anxiety, and cognitive preparation for a threat. Anticipatory anxiety can drive the secretion of mediators like corticotropin, cortisol, and epinephrine, and for this reason, prolonged anxiety and anticipation are likely to result in allostatic load.[44] For example, salivary cortisol concentrations increase within 30 minutes after waking in people who are under considerable psychological stress due to work or family matters.[45] In a related fashion, intrusive memories of a traumatic event (as in post-traumatic stress disorder) can produce a form of chronic stress and can drive physiologic responses.[46]

Allostasis and allostatic load are also affected by the consumption of tobacco and alcohol, dietary choices, and the amount of exercise (Fig. 1). These forms of behavior are integral to the overall notion of allostasis — the way people cope with a challenge — and also contribute to allostatic load by known pathways (e.g., a high-fat diet accelerates atherosclerosis and progression to non-insulin-dependent diabetes by increasing cortisol secretion, leading to fat deposition and insulin resistance[47]; smoking elevates blood pressure and accelerates atherogenesis[48]; and exercise protects against cardiovascular disease[49]).

EXAMPLES OF ALLOSTATIC LOAD

Cardiovascular and Metabolic Systems

The best-studied system of allostasis and allostatic load is the cardiovascular system and its links to obesity and hypertension. In nonhuman primates, the incidence of atherosclerosis is increased among the dominant males of unstable social hierarchies and in socially subordinate females.[50,51] In humans, lack of control on the job increases the risk of coronary heart disease,[52] and job strain (high psychological demands and lack of control) results in elevated ambulatory blood pressure at home and an increased left-ventricular-mass index,[53] as well as increased progression of atherosclerosis.[54] Chronic stress (feelings of fatigue, lack of energy, irritability, and demoralization) and hostility are linked to increased reactivity of the fibrinogen system and of platelets, both of which increase the risk of myocardial infarction.[55,56]

Quantifying allostatic load, a major challenge, has been attempted with the use of measures of metabolic and cardiovascular pathophysiology. In a recent analysis,[57] data from the MacArthur Studies of Successful Aging were used to assess eight measures of increased activity of allostatic systems between 1988 and 1991. Allostatic load was approximated by determining the number of measures for which a person had values in the highest quartile from among the following: systolic blood pressure, overnight urinary cortisol and catecholamine excretion, the ratio of the waist to the hip measurement, the glycosylated hemoglobin value, and the ratio of serum high-density lipoprotein in the total serum cholesterol concentration; and the number of the following for which the person had values in the lowest quartile: serum concentration of dehydroepiandrosterone sulfate and serum concentration of high-density lipoprotein cholesterol. In cross-sectional analyses of base-line data, subjects with higher levels of physical and mental functioning had lower allostatic-load scores and a lower incidence of cardiovascular disease, hypertension, and diabetes. During the three years of follow-up (1988 to 1991), people in this higher-functioning group with higher allostatic-load scores at base line were more likely to have incident cardiovascular disease and were significantly more likely to have declines in cognitive and physical functioning. Among women in this group, increased cortisol secretion predicted a decline in memory.[31]

The Brain

Repeated stress affects brain function, especially in the hippocampus, which has high concentrations of cortisol receptors.[58] The hippocampus participates in verbal memory and is particularly important for the memory of "context," the time and place of events that have a strong emotional bias.[59,60] Moreover, glucocorticoids are involved in remembering the context in which an emotionally laden event took place.[61] Impairment of the hippocampus decreases the reliability and accuracy of contextual memories. This may exacerbate stress by preventing access to the information needed to decide that a situation is not a threat.[62] The hippocampus also regulates the stress response and acts to inhibit the response of the HPA axis to stress.[63,64]

The mechanism for stress-induced hippocampal dysfunction and memory impairment is twofold. First, acute stress increases cortisol secretion, which suppresses the mechanisms in the hippocampus and temporal lobe that subserve short-term memory.[65,66] Stress can impair memory in the short term, but fortunately these effects are reversible and relatively short-lived.[67] Second, repeated stress causes the atrophy of dendrites of pyramidal neurons in the CA3 region of the hippocampus through a mechanism involving both glucocorticoids and excitatory amino acid neurotransmitters released during and after stress.[68] This atrophy is reversible if the stress is short-

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lived, but stress lasting many months or years can kill hippocampal neurons.[23,69] Magnetic resonance imaging has shown that stress-related disorders such as recurrent depressive illness, post-traumatic stress disorder, and Cushing's disease are associated with atrophy of the hippocampus.[70,71] Whether this atrophy is reversible or permanent is not clear.

Long-term stress also accelerates the appearance of several biologic markers of aging in rats, including the loss of hippocampal pyramidal neurons and the excitability of pyramidal neurons in the CA1 region by a calcium-dependent mechanism.[72] Glucocorticoids may mediate these effects by enhancing calcium currents in the hippocampus,[73] since calcium ions have a key role in destructive as well as plastic processes in hippocampal neurons.[74-76] The persistent release of the excitatory amino acid glutamate in the hippocampus after stress in aged rats may also contribute to age-related neuronal damage[27] and may potentiate atrophy and possibly even neuronal loss.

Early stress and neonatal handling influence the course of aging and age-related cognitive impairment in animals. Early experiences are believed to set the level of responsiveness of the HPA axis and autonomic nervous system. These systems overreact in animals subjected to early unpredictable stress and underreact in animals exposed to neonatal handling.[77] In the former condition, aging of the brain is accelerated, whereas in the latter, aging of the brain is reduced.[29,77]

The Immune System

The immune system responds to pathogens or other antigens with its own form of allostasis that may include an acute-phase response as well as the formation of an immunologic "memory." At the same time, other allostatic systems, such as the HPA axis and the autonomic nervous system, tend to contain acute-phase responses and dampen cellular immunity.[78] However, not all the effects are suppressive. Acute stress causes lymphocytes and macrophages to be redistributed throughout the body and to "marginate" on blood-vessel walls and within certain compartments, such as the skin, lymph nodes, and bone marrow. This "trafficking" is mediated in part by glucocorticoids.[78-82] If an immune challenge is not encountered and the hormonal-stress signal ceases, immune cells return to the bloodstream. When a challenge occurs, however, as is the case in delayed-type hypersensitivity, acute stress enhances the traffic of lymphocytes and macrophages to the site of acute challenge.[83,84]

The immune-enhancing effects of acute stress depend on adrenal secretion and last for three to five days. Acute stress has the effect of calling immune cells to their battle stations, and this form of allostasis enhances responses for which there is an established immunologic "memory."[83-85] If the immunologic memory is of a pathogen or a tumor cell, the result of stress is presumably beneficial. If, on the contrary, the immunologic memory leads to an autoimmune or allergic response, then stress is likely to exacerbate a pathologic state. When allostatic load is increased by repeated stress, the outcome is completely different; the delayed hypersensitivity response is substantially inhibited[86] rather than enhanced. The consequences of suppressed cellular immunity resulting from chronic stress include increased severity of the common cold, accompanied by increased titers of cold-virus antibody.[87] In laboratory animals, repeated stress also leads to recurrent endotoxemia, which decreases the reactivity of the HPA axis to a variety of stimuli and decreases production of the cytokine tumor necrosis factor α.[88]

Implications of Allostatic Load in Human Society

The gradients of health across the range of socioeconomic levels[6] relate to a complex array of risk factors that are differentially distributed in human society.[89,90] Perhaps the best example is offered by the Whitehall studies of the British civil service, in which mortality and morbidity were found to increase stepwise from the lowest to the highest of the six grades of the British civil service.[91] Hypertension was a sensitive index of job stress,[92] particularly among factory workers, other workers with repetitive jobs and time pressures,[93] and workers whose jobs were unstable because of departmental privatization (Marmot MG: personal communication). Plasma fibrinogen concentrations, which predict an increased risk of death from coronary heart disease, are elevated among men in the lower British civil-service grades.[56] In less stable societies, conflict and social instability have been found to accelerate pathophysiologic processes and increase morbidity and mortality. For example, cardiovascular disease is a major contributor to the increase of almost 40 percent in the death rate among Russian men during the social collapse that followed the fall of Communism.[94] Blood-pressure surges and sustained elevation are linked to accelerated atherosclerosis[18] as well as to an increased risk of myocardial infarction.[17]

Another stress-linked change is abdominal obesity (see above), measured as an increased waist-to-hip ratio. The waist-to-hip ratio is increased at the lower end of the socioeconomic-status gradient in Swedish men[95] and in the lower civil-service grades in the Whitehall studies.[96] Immune-system function is also a likely target of psychosocial stress,[97] increasing vulnerability to such infections as the common cold.[87,98]

Therapeutic Implications

A consideration of allostatic load is increasingly important in the diagnosis and treatment of many illnesses. Allostatic load is also important in illuminating the relation between disease and social insta-

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bility, job loss, dangerous living environments, and other conditions that are chronically stressful. Medical illness itself is a source of stress, producing anxiety about prognosis, treatment, disability, and interference with social roles and relationships.

Physicians and other health care providers can help patients reduce allostatic load by helping them learn coping skills, recognize their own limitations, and relax. Patients should also be reminded of the interactions of a high-fat diet and stress in atherosclerosis, the role of smoking in cardiovascular disease and cancer, and the beneficial effects of exercise. But the patients themselves must change their behavior patterns appropriately.[99,100]

Beyond these obvious steps, other types of interventions must be considered. Two important causes of allostatic load appear to be isolation[101] and lack of control in the work environment.[52] Interventions that increase social support and enhance coping prolong the life spans of patients with breast cancer,[102] lymphomas,[103] and malignant melanoma.[104] Interventions designed to increase a worker's control over his or her job, such as the reorganization of auto production at Volvo, have also improved health and attitudes toward work.[93]

DISCUSSION

DR. JEFFREY FLIER: Is there any known correlation between lifelong stress (and therefore allostatic load) and Alzheimer's disease?

DR. MCEWEN: There are a few anecdotes from admissions personnel at Veterans Affairs hospitals but nothing concrete. It is interesting, however, that education appears to have a "protective" role against the development of Alzheimer's disease.[105] It is not clear, though, whether education protects against the disease or provides more redundancy in the brain, which delays the symptoms.[106]

DR. BARBARA B. KAHN: What are the important differences between men and women in the biology of stress?

DR. MCEWEN: Estrogens appear to protect the cardiovascular system, and at menopause, women's risk of cardiovascular disease increases to that of age-matched men. The decline in estrogen secretion at menopause also increases the activity of the HPA axis,[107] a development that has been linked to greater cognitive decline among elderly women than among elderly men.[31] A decline in androgen secretion in older men may affect HPA function, although to a lesser extent. In rats, castration increases HPA activity.[108] Finally, there are structural and functional differences between the sexes in hippocampal formation in rodents,[109-111] and behavioral evidence suggests functional and possibly structural sex differences in humans, as well.[112] We do not yet know whether these differences influence the vulnerability of the hippocampus to severe stress, although a number of studies now suggest that female rodents and primates may be less vulnerable than males.[69,113]

DR. FLIER: Is there any evidence that humans are more susceptible to the effects of stress than animals because of the greater human capacity for cognition and insight, as well as the human ability to feel guilt?

DR. MCEWEN: I believe that humans are more at risk for allostatic load than animals, because of the enormous individual differences in stress responsiveness and aging among humans, which relate to life experiences, personality, and physiologic phenotype. However, stress responsiveness and aging also differ among rats, so I don't think we can be definitive about the importance of cognition in our own species.

A PHYSICIAN: What mechanisms underlie the differences between immune responses to acute stress and those to chronic stress?

DR. MCEWEN: These mechanisms are just beginning to be understood. One key process is the redistribution, or trafficking, of immune cells. Acute stress enhances this response to delayed-type hypersensitivity. Chronic stress impairs delayed-type hypersensitivity, with the result that the blood is depleted of fewer lymphocytes. The greater the impairment of delayed-type hypersensitivity, the less the blood is depleted of lymphocytes (Dhabhar FS: unpublished data). Glucocorticoids are responsible for the trafficking of lymphocytes and for the stress enhancement of delayed-type hypersensitivity, but they do not act alone. Various cytokines function as more-local signals, emanating from a site of infection or challenge, and Dr. Firdaus Dhabhar at Rockefeller University is investigating their involvement. Beyond that, it is well known that stress hormones modulate immune function and influence the class of the immune response by their ability to increase the expression of some cytokines and decrease the expression of others.[78]

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IN THE VICTORIAN CIVIL AND ADMINISTRATIVE APPEALS TRIBUNAL
Planning and Environment List

No 2910 of 2012

BETWEEN

CHERRY TREE WIND FARM PTY LTD
Applicant

and

MITCHELL SHIRE COUNCIL
First Respondent

and

TRAWOOL VALLEY-WHITEHEADS CREEK LANDSCAPE GUARDIANS INC
Second Respondent

and

ORS
Respondents

STATEMENT OF DAVID MORTIMER

Filed on behalf of the Second Respondent by:
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Settled by: Peter G Quinn of Counsel

STATEMENT OF DAVID MORTIMER

1. I am David Mortimer of 1251 Canunda Frontage Road, Millicent 5280, South Australia. I am 64 years of age.

2. I am a retired Naval Electrical Engineering Officer and served with the Australian Navy from 1965 to 1988. I served in Vietnam during 1969-70. In my retirement I manufacture fibreglass goods at home. I also attend to my hobbies and maintain my home and grounds

3. My Postal address is PO Box 1010, Millicent SA, South Australia. I can be contacted by telephone on 08 87334380 or 0409 423 056.

I am a "turbine host"

4. My wife, Alida and I own a rural property near Millicent in South Australia.

5. During 2003 we entered a contract with this developer (Babcock and Brown which became Infigen) by which we permitted it to erect 2 of its wind turbines on our land.

6. In about September 2005, we returned from an overseas holiday in the UK, by which time the 2 turbines on our property, along with others forming the Lake Bonney windfarm, had been erected and commissioning had been commenced. My brother, John Campbell Mortimer, hosts 2 turbines on his property which adjoins our farm. He is not a wind farm resident and has no issue with turbines.

7. The 2 turbines we are hosting on our land are approximately 750 m from the original farmhouse on our property ("the old farmhouse"), where we were living at the time of first operation of the Lake Bonney 1 wind farm.

8. Around that time we had commenced building a new house on another of our properties, so we did not spend much time living in the old farmhouse, sleeping there from time to time during the construction of a new farmhouse.

9. We had always planned to build the new farmhouse, hoping to have it completed sometime in 2013 which is the year of my 65th birthday at which time I had planned to retire, but because of the noise being created at the old farmhouse by the turbines on our land and the other turbines nearby we decided to bring forward our plans to build the new farmhouse.

10. Whenever we spent time at the old farmhouse the turbine noise there was quite pronounced and annoying. However, as I have said we did not spend a great deal of time at the old farmhouse once the turbines started operating.

11. The new farmhouse is located on the northern end of the windfarm approximately 2.5 km from the nearest turbines which are situated on land belonging to our neighbours. These neighbours are not wind farm residents. There are 4 turbines in that cluster; the next cluster of 4 turbines are around 5km away, including the 2 close to the old farmhouse. There are 46 turbines altogether in the windfarm next to us.

12. The turbines we host and near us are relatively small by modern standards being 1.75MW Vestas turbines with 33 m blades on 70 m towers. The Vestas V112s proposed by the developer for the Cherry Tree Range have almost double the capacity at 3MW, sit on 90-100 m towers and have 56 m blades.

13. We moved into the new farmhouse on 29 September 2006. As I have said the new farmhouse is approximately 2.5 km from the nearest turbines. It has a brick

exterior with stone interior walls, sits on a concrete slab; it is well insulated and has a corrugated iron roof.

14. From the time we moved into the new farmhouse we started experiencing symptoms and sensations which we now believe are due to turbine noise impacts and which increased in severity over the next 12 months or so.

15. At the new farmhouse the character and level of the noise from the turbines varies depending upon wind speed and to a degree, direction.

16. I describe the noise that comes from the turbines variously as a resonant drumming, thumping and a low whooshing sound. In addition to the audible noise, I experience a pulsating pressure in my skull, particularly in the base of the skull.

17. During our first 12 months living at the new farmhouse I developed tinnitus and apparent irregular heartbeat. I had never had any prior heart trouble and I consulted our GP several times about it. He found nothing wrong with me.

18. Whenever we are staying at the new farmhouse and the turbines are operating I have trouble getting to sleep at night. Frequently, I wake up in the morning feeling desperately tired, as though I have not slept at all. Often I simply fall asleep from exhaustion but still wake up tired. On numerous occasions I experience a deep, drumming, rumbling sensation in the skull behind my ears which is like pressure and often a pulsating, squeezing sensation at the base of my skull. I also experience irregular heartbeat while I am trying to sleep and while I am relaxing (sitting or reclining) in our house. I did not have any trouble sleeping before the turbines started operating.

19. While trying to sleep at the new farmhouse I have used earmuffs (of the kind I use on the tractor) and earplugs, but these do not help me get to sleep and do not change the pressure pulse and drumming sensations that I get in my head.

20. Quite often when I sit down to relax in the new farmhouse (when the turbines are operating) I experience the same pulsing sensation and also experience irregular heart rhythm. I find it impossible to relax in that house and I feel a strong sense of anxiety because of changes to my heart rhythm and the pressure sensation in my head.

21. The trouble I have had trying to sleep in the new farmhouse; the pressure pulse sensations and irregular heart rhythm make me anxious every time I try to sleep or stay in that house. After about a year of being deprived of sleep and the other annoying sensations, I experienced bouts of depression in which I wanted to go to sleep and not wake up. I simply wanted to sleep and stay asleep.

22. The pressure pulsing sensation I have talked about is sometimes like a kind of headache without pain; and at other times it is accompanied by sharp head pains. I did not have any problems with these headaches before the turbines started operating nearby.

23. My wife, Alida began suffering dizzy spells about three years ago and she also now complains about pulsing and pressure sensations in her head when we are home.

24. Both of us have sought medical advice about our symptoms and sensations. We have both had ECGs carried out to investigate my wife's dizzy spells and my irregular heartbeat. The ECG showed that there were no underlying issues with our health to explain the sensations we both experience when we are at the new

farmhouse. The ECG did, however, show that I have a relatively slow resting heart rate.

25. Our experience of life whenever we are living at the new farmhouse (as described above) contrasts with our experience whenever we leave that home and sleep anywhere else. Away from that home, I have not ever experienced problems with my heartbeat or with the pressure pulse sensation in my head; and I sleep incredibly well by comparison. My tinnitus comes and goes when I am away from home, but whenever I am living at the new farmhouse it is a constant source of irritation when the turbines are running. Alida does not complain of dizzy spells or head pressure when we are away from home.

26. As an example, I recently spent a few days and nights with relatives in Adelaide and slept brilliantly, even though their home is right on Brighton Road, Seacliff Park, which is one of Adelaide's busiest arterial roads. Even though the traffic was heavy until late at night I enjoyed the best sleep I have had in weeks and did not experience any trouble with my heartbeat or suffer any headaches or head pressure, in fact, the "silence" inside my head was profound.

27. I have reached the conclusion that the wind turbines operating 2.5 km away are the most likely cause of the sensations suffered by me and my wife (sleep deprivation, the head pressure pulsations, irregular heart rhythm and, in my wife's case, dizzy spells). I honestly believe that these problems are the direct result of wind turbine generated noise, particularly low frequency noise, and regular air pressure variations caused by the turbine blades.

28. We had not had any acoustic survey done at the new farmhouse until recently. During December 2012 and early January 2013 we have had experienced

independent acoustic expert, Les Huson carry out a detailed acoustic survey at the new farmhouse.

29. The data gathered by Mr Huson has been taken away to be analysed. When the data recordings were being collected, Mr Huson took some further readings and showed me a graph on a computer which was taking recordings of the noise generated by the turbines at the time, in real time.

30. Mr Huson pointed out in that graph high levels of low frequency noise which, I understood from the patterns shown in the graph, were consistent with those being produced by the turbines. I could see the data shown in the graph had a regular, rhythmic pattern in the low infra sound range.

31. We are very keen to learn the results of the acoustic survey carried out by Mr Huson.

32. We believe that as a result of wind turbine noise, both audible and inaudible, that the new farmhouse is unliveable and, as such, we will probably be unable to sell it to anyone. Even if we are able to sell it, the sale will be at a substantial discount to its market value; that is the value it would have without turbines operating nearby. The 4Ha block on which our home is built, has no primary production value, only the value attributed to its peace and tranquillity and panoramic views.

33. As I have said, we are in a contractual relationship with the developer in this case (Infigen) by which we receive significant annual income from hosting 2 turbines for it on our property. My brother is also in a contractual relationship with Infigen. Our contract does not contain any of the “gag type” clauses which I

have seen in more modern wind farm contracts with landholders, so I am happy to speak about our experience and give evidence in these proceedings.

Signed by the abovenamed
David Mortimer

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Date: 11 January 2013