The tutorials cover a range of topics around nutrition support in general with a particular focus on nutrition requirements. To facilitate the tutorials you will need to visit www.nutrition2me.com for full details, support information and links to the following free downloads:

- **Nutrition Support eBook sample**: Nutrition Support is 2 books in 1 volume: ‘Energy and nitrogen requirements in disease states’ and ‘Facts, patterns and principles’.
- **FeedCalc Trainer**: Enables the individualised care proposed within ‘Nutrition Support’ to be attained within health service pressure. ‘FeedCalc’ automates estimation of nutritional requirements and feed prescription, checks for adequacy or toxicity and makes a patient record (clinical version only) for re-use.

The Mini-Tutorial series provides you with the opportunity to increase your knowledge in the area of nutrition support, assisting continuing professional development, along with providing a taster of both the Nutrition Support book and the FeedCalc software. Each tutorial has two parts:

- **Clinical scenario**: A clinical state is introduced followed by technical questions and calculations facilitated through FeedCalc.
- **Practice & prescribing**: You simulate a prescribing scenario through FeedCalc to determine optimal prescription, adequacy and possible toxicity.

The third ‘Mini-tutorial’ covers Resting Energy Expenditure (REE), Basal Metabolic Rate (BMR) and Stress Factors, see the next page to read the background information to this tutorial.
Resting Energy Expenditure (REE), Basal Metabolic Rate (BMR) and Stress Factors

REE is most commonly estimated from addition of a stress factor to estimated BMR. Stress factors are obtained by measuring REE in patients, then determining this as a percentage of a standard BMR equation. For example, if REE was 1320 kcal/d and a standard BMR equation estimated BMR as 1200 kcal/d for the same patient, then REE is 110% of BMR, that is, a 10% stress factor.

BMR

BMR is the energy required to maintain cell membrane ion pumps and molecular metabolism (mainly brain, liver and kidney) and involuntary muscle contraction (10-20%) (mainly heart and ventilation).1 BMR per kg body weight declines rapidly from neonate to adult as the proportion of high metabolic rate organ tissue falls (adult %BMR Brain: 19, heart: 10, kidney: 7, liver: 29, muscle 18).2 A slower non-linear decline occurs in adults dependent on changes in fat-free mass (FFM) and its composition.3 The FFM decline is one to two per cent per decade in men who maintain constant weight but FFM loss accelerates in women post-menopause.4 Furthermore, there is reduction in REE/kg FFM related to an age-related decline in exercise and energy intake but this does not occur when exercise and/or energy intake are maintained.5

The most commonly used equations to predict BMR are: Harris-Benedict (HB),7 Schofield (S, SWH when using weight and height),8 and WHO.9 HB was developed from a small dataset containing no children, is commonly mis-quoted and its use with adjusted rather than actual body weight has led to serious error.7,9 WHO and S formulae were developed from large datasets but can significantly overestimate BMR in all populations, particularly in Asian people or the overweight.10, 11,12 New BMR equations were developed from larger databases with a wider ethnic mix.13 Use of FFM has been suggested to improve estimation of BMR but necessitates body composition analysis, itself prone to error. Indeed, while confirming that WHO equations over- and under-estimated low and high REE, respectively, and that HB equations overestimated REE in the underweight, new, BMI-specific equations based on weight, age and sex were found to be as accurate as FFM and FM-based equations.13

Clinically, the USA and UK have recently converted to using Mifflin17 and Henry13 equations, respectively, for estimating REE. Unfortunately, most stress factors used are based on HB equations. Using a HB-derived stress factor with a different BMR equation results in some error. Errors are largest (>10-20%) at the extremes of age (>70y), height (<10th centile) and weight (BMI < 18), that is, the patients least likely to cope with substrate overload or underfeeding. To reduce error, use the same BMR equation from which a stress factor was derived (see CNPD Question 2 onwards).

References: